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# The Oceans and You



Marine Technology Society

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# The Oceans and You

U. S. DEPARTMENT OF COMMERCE NOAA  
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"How fully and wisely the United States uses the sea in the decades ahead will affect profoundly its security, its economy, its ability to meet increasing demands for food and raw materials, its position in the world community, and the environment in which its people live."

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
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TABLE OF CONTENTS

	Page
Introduction	1
Career Prospects in Oceanography--A Realistic Appraisal	3
Employment Possibilities with the Federal Government and a List of State Government Agencies	7
Employment Possibilities with Private Industry	22
Employment Possibilities with Universities	29
Oceanography Curricula	37
Marine Technicians	55
Reading List	59
Sources of Information	72
Personal Actions	76

Second Edition



# Marine Technology Society

1730 M Street, N.W., Washington, D. C. 20036 (202) 659-3251

Dear Friend:

Those of us who spend our lives working with the sea are continuously impressed by its vital significance. Some people live within sight of sea water. Others are thousands of miles away. But on all it has a critical influence.

The world is becoming ever more dependent on the oceans to supplement the dwindling resources of the land. Some of the bounties of the sea, like fish, have been harvested by man since before written history. Others, such as sea floor mineral deposits, are only beginning to show glimpses of opportunities.

The oceans are much more than just a storehouse of resources. They are the prime generator of the very climate in which we live. From the sea comes the rain which waters our crops, and much of the oxygen we breathe. The sea is a worldwide avenue of commerce. It also provides strength and inspiration to hundreds of millions of people who live, work, and play by its waters.

As we make greater and greater use of the oceans for industry, commerce, and recreation, we suddenly find ourselves changing its very nature. We have spilled oil to foul its surface and beaches. We have dumped in pesticide residues and other chemicals to poison its inhabitants. We dredge and fill the estuaries along its margins and wipe out the nurseries for our fisheries.

Such changes result from shortsighted planning and are seriously adverse to our long term well being. We and the rest of the world community must utilize and exploit the oceans in many ways if we are to maintain and improve our standards of living. At the same time, though, we must conserve and protect those oceans if we hope to continue to reap their bounty and to pass the opportunity along to our children.

One of the more rewarding aspects of working in the marine field is the tremendous amount of interest exhibited by the public and especially young people. The purpose of this kit produced by the Marine Technology Society (MTS) is to encourage your interest by providing some basic information together with sources of additional data you can obtain on your own.

Many people look to oceanography as a possible career. We hope to be encouraging. Yet, at the same time, we wish to convey a realistic appreciation of the difficulties and often rigorous requirements involved as well as the opportunities. New fields offer frustration and uncertainty as well as great potential rewards.

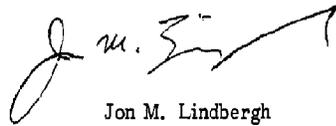
Our underlying purpose is to encourage everyone to learn more about the marine field whether or not they go on to earn their livelihood there. We also want to guide interested persons to the wide range of careers that are present in the marine field, from the research scientist to the subsea miner.

We want to see the maximum number of people gain an appreciation for all aspects of the oceans - their immense power, the delicate balance of the near-shore areas, the potential resource productivity and our need to watch carefully the impact of man's various activities.

In the following pages you will be introduced to a variety of sources of information. Included is a list of colleges and universities offering marine programs as well as institutions with two-year technical programs. A list of sources of additional information is provided as well as a good current bibliography.

If you want to develop your interest in the marine field either as a student, for recreation or as a career field, I suggest it would be beneficial if you take out a membership in the Marine Technology Society. This membership will enable you to keep informed of current developments in government and industry, allow you to participate in active local chapter events around the country and entitles you to publications discounts.

Sincerely,

A handwritten signature in cursive script, appearing to read "Jon M. Lindbergh". The signature is written in dark ink and is positioned above the printed name.

Jon M. Lindbergh

# The Oceans and You

## CAREER PROSPECTS IN OCEANOGRAPHY A REALISTIC APPROACH

(The following is compiled from presentations by Robert B. Abel, director, and Harold Goodwin, deputy director, National Sea Grant Program, with the authors' permission.)

### What's an Oceanographer?

Generally speaking, ocean scientists are concerned with studies of the nature of, and processes in, the ocean, the air-sea surface, and the ocean bottom, and interrelationships among the creatures that live within. Ocean engineers determine how to make the ocean work for mankind and make things work in the ocean. Technicians assist scientists and engineers in their work. Social scientists are concerned with law of the sea, economics of resource recovery, administration of oceanographic programs, and sociological factors having to do with people who work on, about, or under, the ocean. Oceanography adds to our general welfare in several ways by helping us use the ocean as a source of food, minerals, recreation, pharmaceuticals, transportation, etc.

To be a research oceanographer today practically requires a doctoral degree if one is to gain recognition and good employment. Again, there are exceptions. People of unusual brilliance and talent sometimes can make it without such credentials. But let's face it: most aren't that brilliant or talented.

There are physical, chemical, geological, and biological oceanographers, but - at least among the good scientists - the distinctions blur. For instance, a biological oceanographer can't understand the population dynamics of fish species, or he can't understand the vital food chains of the sea, unless he has good knowledge of the physical behavior of the sea, its chemistry, and geology. A chemical oceanographer can't really comprehend the organic chemistry of a body of water without knowing its physics, geology, and biology. More than in any other field, the oceanographer, regardless of his basic specialty, must be a generalist - a jack of all sciences. And that takes a lot of learning and a lot of experience. That's one reason why a doctoral degree is practically essential.

Of course there are specialists among the oceanographers, too. I know a chemical oceanographer who has spent his entire working lifetime on just one element - nitrogen. It happens to be a pretty vital element, and he's been tracing it through the food web of the sea, getting deeper and deeper every year. Another friend is a physical oceanographer who hasn't been to sea in ten years. His data comes to him, collected by others. He's a theoretician, and an excellent one, who works on theory of wave information and propagation and develops computer models to show how the sea surface behaves. A biological oceanographer friend spends most of his time identifying and cataloguing the echinoderms of the sea - a family group that includes sea urchins, sand dollars, and starfish. He's a taxonomist, which is to say he practices the science of classification, putting animals into their proper place in the scheme of things. All these are vital specialties, on which the work of other scientists of the sea will be based. But every one of these people was a generalist first, and chose to move into a specialty of personal interest to him.

## The Study of the Oceans

Normally, oceanography is taught at the post graduate level. In order to do competent research in oceanography, it is necessary to have at least a master's degree (and preferably a doctorate) either in oceanography or in one of the component basic sciences, such as chemistry, physics, geology, or biology. Mathematicians have a place in all fields related to oceanography. Engineers have traditionally performed competently with a bachelor's degree, but more are now proceeding to advanced degrees. Administrators or persons concerned with sales can probably perform quite competently with a bachelor's degree.

Technicians are normally products of two year colleges such as community colleges or junior colleges, and quite often have attained some kind of associate degree in ocean technology. Technicians are extremely productive in all fields of oceanography, including operations at sea, instrumentation maintenance and repair, and data processing.

Do you hate mathematics and find it hard to handle? If so, forget about a career as a physical or chemical oceanographer. You won't make it. Math is vital.

Do funny looking creatures, or dissecting them in the lab, give you the willies? Forget marine biology.

Do you prefer to work with your hands? Are you happy when doing active things, and miserable doing skull work over endless papers? Then you're not a scientist type, and probably not an advanced type of engineer. Scientists and engineers have to enjoy problem solving in theoretical - and often abstract - terms. If that's not your bag, perhaps you're a manager, a marketer, or a technician.

Would you rather communicate with people than do theoretical work, or routine work? You might have the makings of an extension agent. Or, if you're good enough, you might be a journalist, information specialist or a photographer.

Take a good look at yourself. It's your life, and you want to live it as happily and productively as you can. What keeps you contented? If you're not a scholar, it may not even be desirable to go to college and work for graduate degrees. If you are a scholar you probably can make the higher education levels.

In terms of money - income from a career - the final factor is what you're worth to an employer. Each employer has standards, of course, and you want to be sure you can meet the educational and experience requirements for the kind of job you're shooting for.

If you want to be a teacher, at any level, you need academic credits. And, by the way, the nation needs good teachers, who want to teach. It's about the best career there is, in terms of satisfaction to a person - even though it isn't the career with the biggest income. Teachers of marine subjects always will be needed.

To be a researcher also means lots of education. To be a technician means less - and I know a number of technicians who are making more money than many researchers.

JUL 7 1975

### Career Prospects at Sea

About 40 per cent of persons involved in marine science work for the U. S. Government; an equal number work and teach at academic institutions; the remainder work in industry. In the government, oceanographers are employed by the Departments of Defense, Commerce, Interior, Health Education and Welfare, and Transportation. They are also employed in the National Science Foundation, Atomic Energy Commission, National Aeronautics and Space Administration, and Smithsonian Institution.

About 40 per cent of oceanographers, ocean engineers, etc., are employed by academic institutions where they teach and carry out research. Many universities retain the most promising of their graduate students to teach and to do research in their own laboratories. Others believe that it is better to cross-fertilize, by encouraging their students to transfer to other institutions, industries, or Federal agencies in order to spread ideas and techniques.

First, oceanographers always will be a minority among the Sea People. A greatly expanded ocean program will mean a need for more oceanographers, but not many thousands. There wouldn't be enough ships, laboratories, tasks to serve them, or money to pay them. At present, about 1,800 oceanography and ocean engineering students already are in graduate school. Unless the Federal government starts putting more money into oceanography pretty soon, those students are not going to have an easy time finding jobs when they emerge from the education pipeline with their brand new degrees in hand.

In fact, there is a shortage of jobs in some specialties right now. We have more biological oceanographers than we can profitably employ. We also have a surplus of geological oceanographers. There may be room for a few more physical oceanographers, and there certainly is room for more chemical oceanographers - and the reason for this is quite simple: it is harder, and it takes longer, to get a doctoral degree in physics or chemistry.

Is there a career in oceanography? You bet there is. But there are not jobs just for the taking, for anyone who thinks he wants to be an oceanographer, any more than there are jobs for everyone who wants to be a nuclear physicist or a space scientist. As always, the jobs will go to the young people who have the most to offer, as shown by their academic records and experience.

### In Conclusion

It is important to understand that in any field which appears to be burgeoning as fast as oceanography, there will be a tendency on the part of many authors to "ride the band wagon" or to glorify the field more than may be warranted by its growth or future potential. Be skeptical of exaggerated claims, particularly in books written for popular consumption, about careers in oceanography. Most of these err considerably on the optimistic side. Enthusiasm for this field should be liberally tempered with caution and discretion. The employment market right now is poor, and, in several subordinate categories of oceanography, supply seems about to exceed demand. This is particularly true for biological and geological oceanography. For the time being, there appears to be a good future for engineers and technicians, and also for a few ocean-oriented behavioral scientists....

If per chance you intend to study oceanography because you feel the employment opportunities are great, rather than because of a basic love for the science - don't! For every student enrolled in oceanography and closely related subjects in 1960, just one decade ago, between 12 and 15 are so

enrolled today. Since most work in oceanography is supported or fostered either directly or indirectly by the United States government, it follows that the future in this field will continue to revolve about the Federal budget. The sad fact is that this budget has not been rising very fast. Accordingly the foreseeable future contains little, if any, strong new employment demand in oceanography.

Ocean development will take place, because it must. We need the products of the sea, and we need the sea itself as the principal source of the oxygen we breathe, and as the regulator of our climates. We need to understand the sea to understand our planet. We need sea business and industries to keep our economy growing. We also need marine conservation, and the preservation of great areas of sea and shore as natural preserves.

We will get these things. But we will get them from evolution - gradual growth - not from revolution or a sudden explosion.

# The Oceans and You

## EMPLOYMENT POSSIBILITIES WITH THE FEDERAL GOVERNMENT and A LIST OF STATE GOVERNMENT AGENCIES

To give you an idea of the different possible job locations within the Federal government, we asked representative major employers in the marine field to supply current information about themselves.

Instead of generalizations about work for the Federal government, we thought more specific reports from varied employment centers would be instructive. For general information, write the U. S. Civil Service Commission, Washington, D. C. 20415 (or a regional office in your state) for basic guidance on working for the Federal government. If your interest is in a scientific career you should so specify in your request for information.

Our sampling is not all-inclusive. Should you want to look into additional places of employment in the Federal government, you will want to consult a basic reference such as either the "Congressional Directory" or the "Government Organizational Manual" for the current year which contain lists and descriptions of the entire Federal apparatus.

While we have concentrated on Federal government employment, you should not overlook possibilities with state and local governments. Attached is a list of environment employment groups within each state government. Also, contact a representative to your state legislature for guidance, or write the governor's office for information about state-level activity in water pollution control, coastal zone management, fisheries or related areas.

The statements in this section were prepared by the agencies themselves and present the employment picture as of the fall, 1972.

### OFFICE OF NAVAL RESEARCH

The Office of Naval Research (ONR) was established by Public Law 588, 79th Congress, August 1, 1946. The Office of Naval Research is divided into a headquarters organization and constituent field activities.

The primary function of the Office of Naval Research is to plan, initiate, and coordinate naval research to assure the maintenance of future naval power and the preservation of national security. The Office of Naval Research is responsible for supervising, administering, and controlling all activities within or on behalf of the Department of the Navy that relate to patents, invention, trademarks, copyrights, and royalty payments. In the final analysis, it is the Office of Naval Research that must carry out most of the missions to which all of the Department of the Navy's research efforts are devoted. The Office of Naval Research celebrated its twenty-fifth anniversary on August 1, 1971 and has endeavored to broaden its scope in research in the future.

Presently, the Office of Naval Research has a ceiling of 398 full-time permanent employees. Forty-three percent or 176 employees constitute the scientific division. The financial area is composed of 69 employees or 16.8 percent of the total ceiling. The procurement branch consists of 53 employees or 13.8 percent of the ceiling. Forty-nine employees comprise the patent branch which make up 12.9 percent of the ceiling. The administration directorate is manned by 33 employees or 8.0 percent of the ceiling, and the personnel branch is composed of 3.3 percent of the ceiling which is 13 employees. The

The Chief of Naval Research staff is 2.2 percent of the total. There are 52 employees with Ph. D degrees and 23 employees in the supergrades. ONR has 50 military personnel.

The Navy needs assistance in improving techniques for predicting conditions in the ocean and atmosphere, and in obtaining design data for a wide variety of new equipment, particularly for equipment that can operate at great depths.

Over the next five years ONR envisions an average yearly turnover of 10 percent of its scientific staff; an average of 10 percent turnover in its procurement and financial management staff, and a 30 percent turnover in its clerical staff. Because of the complexity of the research that ONR is involved in and the resulting necessity to have the most highly qualified scientists on its professional staff, ONR will continue to recruit the outstanding members of the scientific community in all the science areas.

Recognizing the invaluable contribution of our administrative, financial management, and contract-procurement staff in the accomplishment of ONR mission, the recruitment of the most highly qualified persons in these fields will continue to be our goal.

#### U. S. COAST GUARD

The United States Coast Guard, an administration of the U. S. Department of Transportation and one of the five armed forces, is a multi-mission organization dedicated to maritime safety. Headquarters are in Washington, D. C. and twelve district offices are located in Boston, St. Louis, New York, Portsmouth, Va., Miami, New Orleans, Cleveland, Long Beach, San Francisco, Seattle, Honolulu and Juneau.

The missions are described briefly as follows:

Search and Rescue - Coast Guard ships, planes (fixed wing and helicopters) and stations perform thousands of assistance missions each year on the high seas and in inland waters. Fifty thousand responses to request for assistance were made in 1970.

Aids to Navigation - The Coast Guard constructs, establishes and maintains more than 46,000 aids to navigation in the waters of the United States and its possessions. These aids range from buoys and day markers to sophisticated electronic transmission stations called LORAN (Long Range Aids to Navigation) and are utilized by vessels, aircraft and pleasure boats.

Law Enforcement - As primary marine law enforcement agency of the government, the Coast Guard is responsible for enforcement of U. S. regulations in our federal waters and on the high seas. This includes policing our waters for violation laws pertaining to water pollution.

Merchant Marine Safety - The Coast Guard is responsible for the safety of our merchant marine fleet. Maintaining the highest safety standards in the world requires plan approval for construction of merchant vessels, periodic vessel inspection, licensing of merchant marine personnel, research and development of new equipments, techniques and safety procedures as well as investigation of merchant marine accidents.

Oceanography, Meteorology and Polar Operations - The U. S. Coast Guard operates several oceanographic vessels, six ocean stations providing weather information around the clock to the U. S. and all of the American polar ice-breakers. The latter vessels are used for resupply of U. S. bases in the polar

regions, search and rescue for vessels in the ice areas, scientific research and domestic icebreaking.

Boating Safety - The Coast Guard is responsible for maintaining safe boating standards for the millions of pleasure boatmen in the United States. This includes enforcement of laws, education of boatmen, liaison with industry and state governments and overseeing the registration of pleasure boats.

Military Preparedness - As one of the five Armed Forces of the United States, the Coast Guard maintains a state of military and operational readiness in order to function effectively as a specialized service in the Navy in times of war, and to meet contingency or other high priority requirements when a declared state of war does not exist. A Coast Guard Reserve is maintained and trained in the event mobilization is required.

Bridge Administration - The Coast Guard insures the safe and unencumbered passage of marine traffic on the Nation's waterways, and cooperates with other agencies to insure that the needs of all using surface transportation are met without unduly impeding marine transportation. The Coast Guard is composed of 38,000 military and 5,500 civilian employees. Officers are graduates of the Coast Guard Academy, New London, Conn., college graduates who have gone to officer candidate school and former officers of the U. S. merchant marine.

Enlisted personnel serve voluntary tours consisting mainly of a four-year obligation.

Civilian employees range from file clerks through executive and include scientists, oceanographers, engineers, etc.

Personnel interested in employment in the Coast Guard may request information from one of the following sources:

Civilian Positions	Military Recruitment
Civilian Personnel Division	U. S. Coast Guard (PTP-2)
U. S. Coast Guard	400 7th St. Street, S.W.
400 7th Street, S.W.	Washington, D. C. 20590
Washington, D. C. 20590	

#### MARITIME ADMINISTRATION

##### Particulars Regarding Employment In The U. S. Merchant Marine

The Maritime Administration, U. S. Department of Commerce, Washington, D. C. , does not engage applicants for seafaring employment, as this is the responsibility of the various steamship companies operating ships of the merchant marine. These companies are governed in their procedures by established company policy, industry practice, and collective bargaining agreements with seafaring labor unions.

There is now a decline in seafaring employment which is expected to continue for some time. Therefore, it is reasonable to assume that competition will be very keen for available jobs. Positions for entry-level ratings (no experience) are extremely limited, and part-time or summer employment is not encouraged. Students, male or female, will find it impossible to work passage to foreign ports for personal travel. Conditions do not permit termination of a seaman's service in a foreign port. Further, employment in the merchant marine does not fulfill one's obligation under the Selective Service Act.

The Maritime Administration is not sponsoring training programs as it

did during World War II. We do, however, endorse programs afforded by the various seafaring labor unions. The unions are familiar with local shipping conditions at any specific port and can provide information regarding training opportunities, qualifications for employment, wage scales, and other items of related interest.

#### Merchant Mariner's Document

No person may be employed on U. S. flag merchant vessels of 100 gross tons or over who has not first applied for and been issued a merchant mariner's document. Application for a mariner's document comes within the jurisdiction of the U. S. Coast Guard, the regulatory agency responsible for licensing and documentation of all U. S. merchant seamen.

#### Pay and Fringe Benefits

Crew members of American merchant ships enjoy excellent conditions of pay, subsistence and work. Most jobs provide 120 days paid vacation per year, some even longer. An example of average pay by a cross section of ratings on a modern freighter is as follows:

<u>RATING</u>	<u>MONTHLY BASE PAY</u>	<u>OVERTIME</u>	<u>TOTAL</u>
Radio Operator	\$1162	\$464	\$1626
Second Ass't. Engr.	997	470	1467
Third Mate	893	461	1354
Able Seaman	528	285	813
Fireman-Watertender	528	285	813
Ordinary Seaman	413	217	630
Wiper	491	103	594
Food Handler	410	164	574

#### Shipboard Employment Opportunities for Women

Seafaring employment opportunities for women are limited. Positions as waitress or stewardess are normally handled through a joint effort of seafarer labor unions and steamship companies. The name and address of a union which places women is the Marine Cooks and Stewards Union, 350 Fremont Street, San Francisco, California 94105.

On passenger ships beauticians, barbers, hairdressers, social directors, sales persons and entertainers are engaged by firms who perform these services aboard ship on a concession basis. Further information regarding such positions may be available from the following steamship companies:

American President Lines, Ltd. 601 California Street San Francisco, California 94108	Pacific Far East Lines, Inc. 141 Battery Street San Francisco, California 94105
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Registered nurses are employed aboard passenger vessels, and the number of such positions is extremely limited. Selection of applicants (nurses) is generally the responsibility of the Port Medical Director of each steamship company. There are only four passenger ships operating at the present time, all of which are based at Pacific coast ports.

The Independent Tanker Association, which represents the employees of several major tanker companies, may be able to suggest shipboard employment with tanker operators who hire personnel through company facilities. The Independent Tanker Association maintains its office at 53 Park Place, New York, New York 10007.

The Lake Carriers Association, 1411 Rockefeller Building, Cleveland, Ohio 44113 can furnish information regarding employment opportunities on the Great Lakes.

Formal Maritime Training

An applicant interested in formal schooling to prepare for a career at sea as a deck or engineering officer must be a United States citizen, at least 17 and not have passed his 22nd birthday on July 1 of the year of admission. He must also be a high school graduate, unmarried, and in excellent physical condition. Applicants may communicate directly with any of the following institutions regarding courses in nautical science or marine engineering:

U. S. Merchant Marine Academy

Superintendent  
United States Merchant Marine Academy  
Kings Point, New York 11024

State Academies

President New York State Maritime College Fort Schuyler, New York 10465	President Massachusetts Maritime Academy Buzzards Bay, Massachusetts 02537
Superintendent Maine Maritime Academy Castine, Maine 04421	Superintendent California Maritime Academy Vallejo, California 94591
Superintendent Texas Maritime Academy Galveston, Texas 77550	Director, Maritime Programs Northwestern Michigan College Great Lakes Maritime Academy Traverse City, Michigan 48213

MILITARY SEALIFT COMMAND, NAVY

Military Sealift Command (MSC) is responsible for providing contingency sealift for all Department of Defense organizations. To develop wartime capability, it provides sea transportation for worldwide defense units in peacetime, shipping military cargo on scheduled U. S. liners and in its own government-owned ships. The command also charters vessels, tankers, cargo ships and ships for special research or functional projects. The command employs 7,000 civil service mariners in seagoing jobs and has other marine specialists in shore berths. Employment opportunities exist for marine transportation specialists, marine engineers and naval architects. Salaries range from \$7,319 to \$13,309 per annum. Positions for higher level positions than these generally are filled via promotion. The marine transportation specialists apply technical ocean transportation knowledge (typically acquired in the maritime industry or similar marine-type organizations) in managing and providing shipping services for the large-scale, global movement of cargo and petroleum products. The naval architects and marine engineers provide engineering services necessary to design, construct, maintain, repair, and alter ships. A bachelor's degree in any recognized merchant marine academy provides an excellent background for many MSC positions. Applicants for employment must be on a register of eligibles maintained by the U. S. Civil Service Commission. Information concerning relevant examinations should be obtained from the U. S. Civil Service Commission, Washington, D. C. 20415.

ENVIRONMENTAL PROTECTION AGENCY

Environmental Protection Agency, Washington, D. C., is an independent regulatory agency that reports directly to the President. It is organized into a Washington headquarters office and ten regional offices located in the following cities: Boston, New York, Philadelphia, Atlanta, Chicago, Dallas, Kansas City, Denver, San Francisco and Seattle. In brief, the functions of EPA are:

1. To establish and enforce environmental protection standards.

2. To conduct research on the effects and control of pollution, and to gather information and recommend policy changes.
3. To assist State and local governments and to help public and private agencies and institutions through technical assistance and through grants.
4. To assist the Council on Environmental Quality in developing and recommending new policies to the President.

To accomplish the formidable task facing it, EPA will require college graduates, including those with advanced degrees, in such fields as engineering, law, economics, chemistry, biology, hydrology, geology, mathematics, oceanography, soil science, planning, data processing, management analysis, budget and financial management, personnel administration, toxicology, enforcement and physical science administration.

A source of additional information about the Environmental Protection Agency is the Office of Public Affairs which can furnish a variety of information pamphlets, brochures, press releases etc. They are located in EPA, Room 3012A, 4th and M Streets, S. W., Washington, D. C. 20460.

#### NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

The National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce has several major organizational elements which are involved in marine science and technology.

The National Ocean Survey prepares nautical and aeronautical charts, conducts precise geodetic, oceanographic, and marine geophysical surveys, and predicts tides and currents.

The National Weather Service reports the weather of the United States and possessions, provides weather forecasts to the general public, issues warnings against tornadoes, hurricanes, floods, and other atmospheric and hydrologic hazards, and provides a broad array of special services to aeronautical, maritime, astronautic, agricultural, and other weather-sensitive activities.

The National Marine Fisheries Service seeks to discover, describe, develop, and conserve the living resources of the global sea, especially as these affect the American economy and diet.

The Environmental Research Laboratories conduct the fundamental investigations needed to improve man's understanding of the physical environment.

The Office of Sea Grant administers and directs the National Sea Grant Program.

The Data Buoy Project Office is developing a national system of automatic ocean buoys for obtaining essentially continuous marine environmental data.

The Marine Minerals Technology Center is concerned with the development of marine mining and related technology, with emphasis on the assessment of environmental impact of mining systems.

The National Oceanographic Instrumentation Center provides the national focal point for knowledge of technology related to instrument measurement, evaluation, and the reliability of sensing systems for ocean use.

These organizational elements are working together to improve the safety

and quality of life, the efficiency and timing of oceanic hunts and harvests, and man's comprehension, use, and preservation of his planetary home.

Physicists, engineers, mathematicians, meteorologists, cartographers, oceanographers, geophysicists, chemists, fishery biologists, hydrologists, and computer specialists are among the many types of occupations represented in accomplishing this mission.

NOAA also offers challenging career opportunities to high school and junior college graduates as meteorological technicians, cartographic aides, Survey aides, and physical science technicians.

A sample specification follows, that for oceanographer:

#### Nature of Work

Most NOAA oceanographers are responsible for planning, conducting, and participating in programs of research, development, test and evaluation, as applicable to the solution of environmental problems, in the sphere of oceanic phenomena.

Special attention is focused on tides, and the dynamics of the oceans; the land-sea and air-sea interface; and studies of the geophysical properties of the ocean floor, as well as studies of its biological content.

Duties are generally performed during the regular five-day work week, except when at sea. Travel is usually limited, except in connection with special projects. Special attention is given to the application of automation and computer technology in the oceanographer's work.

Occasionally, an oceanographer may be detailed to a resource biology program for a definite period of time, as part of a team. This may occur when a specific oceanographic resource problem must be solved.

#### Location of Work

Laboratories and offices are located at Norfolk, Virginia; Seattle, Washington; Miami and St. Petersburg, Florida; Detroit, Michigan; Juneau, Alaska; Gloucester, Massachusetts; Boulder, Colorado; Silver Spring and Rockville, Maryland; and Honolulu, Hawaii.

#### General Qualifications

GS-5 - B. S. degree with at least 24 semester hours in oceanography, or a related discipline such as physics, meteorology, geophysics, mathematics, chemistry, engineering, geology, or biology, plus 20 semester hours in a combination of oceanography, physics, geophysics, chemistry, mathematics, meteorology, and engineering sciences. Candidates who qualify on the basis of a major in geology, must show at least six semester hours in a pertinent major directly concerned with marine science or oceanography; candidates who qualify on the basis of other physical sciences, engineering, or mathematics, must have completed differential and integral calculus and at least six semester hours in physics.

GS-7 and above - In addition to the above requirements, graduate study or professional work experience in the field of oceanography or a related science which has provided a basic knowledge of oceanography.

Graduate degrees or additional experience may qualify applicants for higher grade positions.

Oceanography Career Ladder - NOAA Wide

<u>Pay Grade</u>	<u>Percentage</u>
Executive Level	3%
15	7%
14	13%
13	18%
12	21%
11	23%
9	10%
5 to 7	<u>5%</u>
TOTAL	100%

U. S. NAVAL OCEANOGRAPHIC OFFICE

The U. S. Naval Oceanographic Office, in the past a major employment center in the marine field within the Federal government, is undergoing reorganization. As of fall, 1972 it was not possible for that installation to describe its employment situation and prospects. Interested persons may write the office in Suitland, Maryland (full address given in the Sources of Information Section) for a current report.

U. S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

Although the Geological Survey has no careers in oceanography per se, its involvement with the geology of the continental shelf provides a number of marine-related jobs. A brief description of the overall role of the agency from a Civil Service Commission discussion of Federal employment opportunities in environment-related jobs says that the Geological Survey "operates many research projects regarding geological environments, including the exploration of the sea floor, and a program of regional geologic analysis and detailed mapping which is used to develop new scientific approaches to industrial site selection, highway engineering and overall management of land, in addition to serving as an exploration aid for economic deposits of useful minerals and fields. It is also involved in 1,600 research and basic data projects on the Nation's water resources. Skills needed: cartographers; chemists; chemical, civil, hydraulic, mining, and petroleum engineers; geologists; geophysicists; hydrologists; physicists; mathematicians; computer specialists."

STATE AGENCIES

ALABAMA: Dept. of Agriculture and Industries, Montgomery 36104. Dept. of Conservation, Montgomery 36104. State Soil and Water Conservation Committee, Montgomery 36104. Water Improvement Commission, Montgomery 36104. Alabama Cooperative Fishery Unit, Auburn University, Auburn 36830. Alabama Cooperative Wildlife Research Unit, Auburn University. Conference on Natural Beauty, Alabama Planning and Industrial Development Board, Montgomery 36104.

ALASKA: Dept. of Fish and Game, Juneau 99801. Dept. of Health and Welfare, Juneau 99801 (water pollution control unit). Dept. of Natural Resources, Juneau 99801. Alaska Cooperative Wildlife Research Unit, University of Alaska, College 99701. Conference on Natural Beauty, Dept. of Natural Resources, Division of Agriculture, Box 800, Palmer 99845.

ARIZONA: Bureau of Mines, University of Arizona, Tucson 85721. Game and Fish Dept., Phoenix 85007. Land Dept., Phoenix 85007. Outdoor Recreation Coordinating Commission, Phoenix 85023. State Division

of Soil and Water Conservation, Phoenix 85007. Arizona Cooperative Fishery Unit, University of Arizona, Tucson 85721. State Dept. of Health, Phoenix 85007. Arizona Cooperative Wildlife Research Unit, University of Arizona.

ARKANSAS: Forestry Commission, Little Rock 72203. Game and Fish Commission, Little Rock 72201. Pollution Control Commission, Little Rock 72202. Publicity and Parks Commission, Little Rock 72201. State Committee on Stream Preservation, Box 447, Bentonville 72712. State Plant Board, Little Rock 72203. Governor's Conference on Arkansas Beauty, Little Rock 72201.

CALIFORNIA: Bureau of Health Education, Physical Education and Recreation, Sacramento. Dept. of Agriculture, Sacramento 95814. East Bay Regional Park District, Oakland 94619. The Resources Agency, Sacramento 95814. State Land Commission, 305 State Bldg., Los Angeles 90012. California Cooperative Fishery Unit, Humboldt State College, Arcata 95521. Conference on California Beauty, Dir., Dept. of Parks and Recreation, Sacramento 95811.

COLORADO: Bureau of Mines, Denver 80203. Dept. of Agriculture, Denver 80203. Dept. of Education, Denver 80203. Dept. of Health, Denver 80220. Dept. of Natural Resources, Denver 80203. State Board of Land Commissioners, Denver 80203. State Forest Service, Colorado State University, Fort Collins 80521. State Soil Conservation Board, Denver 80203. Water Conservation Board, Denver 80203. Colorado Cooperative Fishery Unit, Colorado State University. Annual Governor's Conference on Parks and Recreation, Director, Game, Fish and Parks Dept., Denver 80216.

CONNECTICUT: Board of Fisheries and Game, Hartford 06115. Dept. of Agriculture and Natural Resources, Hartford 06115. Dept. of Agriculture and Natural Resources Shell Fish Commission, Box 97, Milford 06460. Geological and Natural History Survey, Wesleyan University, Middletown 06457. State Park and Forest Commission, Hartford 06115. State Soil Conservation Advisory Committee, State Office Bldg., Hartford 06115. Water Resources Commission, Hartford 06115. Governor's Conference on Natural Beauty, Wethersfield 06109.

DELAWARE: Board of Game and Fish Commissioners, Dover 19901. Geological Survey, University of Delaware, Newark, Delaware 19711. Soil and Water Conservation Commission, POB 567, Georgetown 19947. State Board of Agriculture, Dover 19901. State Forestry Dept., Dover 19901. State Park Commission, Wilmington 19808. Water and Air Resources Commission, Dover 19901. Conferences on Natural Beauty, Director, Planning Office, 45 the Green, Dover 19901.

DISTRICT OF COLUMBIA: Dept. of Public Health, Washington, D. C. 20001. Metropolitan Police, Washington, D. C. 20001. District of Columbia Interagency Committee on Beautification Programs, 14th and E Streets, N. W., Washington, D. C. 20004. The First Lady's Committee for a More Beautiful Capitol, Washington, D. C. 20036.

FLORIDA: Board of Conservation, Tallahassee 32304. Board of Parks and Historic Memorials, Tallahassee 32304. Central and Southern Florida Flood Control District, POB 1671, W. Palm Beach 33402. Dept. of Agriculture, Tallahassee 32304. Forest Service, Tallahassee 32304. Game and Fresh Water Fish Commission, Tallahassee 32304. Institute of Marine Sciences, University of Miami, Coral Gables 33124. Marine Facility, Florida State University, Tallahassee 32306. Outdoor Recreational Development Council, Tallahassee 32303. State Board of Health, POB 210,

Jacksonville 32201. State Soil and Water Conservation Board, Drawer EE, Gainesville 32601. Governor's Conference on Natural Beauty, Outdoor Recreational Development Council.

GEORGIA: Dept. of Agriculture, Atlanta 30334. Dept. of State Parks, Atlanta 30334. Forestry Commission, Box 819, Macon 31202. Institute of Natural Resources, University of Georgia, Athens 30601. State Council for the Preservation of Natural Areas, Decatur 30030. State Game and Fish Commission, Atlanta 30334. State Soil and Water Conservation Commission, Athens 30601. University of Georgia Marine Institute, Sapelo Island 31327. Water Quality Control Board, Atlanta 30334. Georgia Cooperative Fishery Unit, University of Georgia. Governor's Conference on Natural Beauty, Dept. of State Parks.

HAWAII: Dept. of Agriculture, Box 5425, Honolulu 96814. Dept. of Health, Box 3378, Honolulu 96801. Dept. of Land and Natural Resources, Box 621, Honolulu 96809. Institute of Marine Biology, University of Hawaii, Kaneohe 96744. Water Resources Research Center, University of Hawaii, Honolulu 96822. Hawaii Cooperative Fishery Unit, University of Hawaii. Governor's Conference on Natural Beauty and Community Appearance, Dept. of Planning and Economic Development, Honolulu 96813.

IDAHO: Bureau of Mines and Geology, Moscow 83943. Dept. of Agriculture, Boise 83701. Dept. of Health, Boise 83707. Dept. of Public Lands, Boise 83707. Department of Reclamation, Boise 93701. Fish and Game Dept., Boise 83707. State Soil Conservation Commission, Boise 83707. Idaho Cooperative Fishery Unit, University of Idaho, Moscow 83834. Idaho Cooperative Wildlife Research Unit, University of Idaho. Governor's Anti-Littering and Beautification Conference, Office of the Governor, Boise 83707.

ILLINOIS: Dept. of Agriculture, Springfield 62706. Dept. of Conservation, Springfield 62706. Dept. of Public Works and Buildings, Springfield 62706. Nature Preserves Commission, Rockford 61103. Sanitary Water Board, Springfield 62706. State Geological Survey, Urbana 61801. State Natural History Survey Division, Urbana 61801. Keep Illinois Beautiful Program, Dept. of Public Works and Buildings.

INDIANA: Dept. of Natural Resources, Indianapolis 46204. State Board of Health, Indianapolis 46206. Stream Pollution Control Board, Indianapolis 46206. State Soil and Water Conservation Commission, Purdue University, Lafayette 47907. Governor's Conference on Natural Resources and Natural Beauty, Dept. of Natural Resources.

IOWA: Dept. of Agriculture, Des Moines 50319. Dept. of Health, Des Moines 50319. Geological Survey, Iowa City 52240. Natural Resources Council, Des Moines 50319. State Conservation Commission, Des Moines 50319. State Soil Conservation Committee, Des Moines 50319. Water Pollution Control Commission, Des Moines 50319. Iowa Cooperative Fishery Unit, Iowa State University, Ames 50010. Iowa Cooperative Wildlife Research Unit, Iowa State University. Iowa Conference on Natural Beauty, Conservation Commission, Des Moines 50308.

KANSAS: Forestry, Fish and Game Commission, Pratt 67124. Geological Survey, University of Kansas, Lawrence 66044. State Biological Survey of Kansas, University of Kansas. State Board of Agriculture, Topeka 66612. State Dept. of Health, Topeka 66612. State Park and Resources Authority, Topeka 66612. State Soil and Conservation Committee, Topeka 66612. Water Resources Board, Topeka 66612. Governor's Council on Beautification, State Park and Resources Authority, Topeka 66612.

KENTUCKY: Dept. of Agriculture, Frankfort 40601. Dept. of Fish and Wildlife Resources, Frankfort 40601. Dept. of Parks, Frankfort 40601. Dept. of Public Information, Frankfort 40601. Geological Survey, University of Kentucky, Lexington 40506. Water Pollution Control Commission, Frankfort 40601. Kentucky Clean-up and Beautification Conferences, Dept. of Natural Resources, Frankfort 40601.

LOUISIANA: Dept. of Agriculture, Baton Rouge 70804. Forestry Commission, Baton Rouge 70815. Geological Survey, Baton Rouge 70803. State Dept. of Conservation, Baton Rouge 70804. State Parks and Recreation Commission, Baton Rouge 70821. State Soil and Water Conservation Committee, Louisiana State University, Baton Rouge 70803. Wildlife and Fisheries Commission, New Orleans 70130. Louisiana Cooperative Fishery Unit, Louisiana State University. Louisiana Cooperative Wildlife Research Unit, Beautification, P. O. Box 44316, State Capitol.

MAINE: Baxter State Park Authority, Augusta 04330. Dept. of Agriculture, Augusta 04330. Dept. of Inland Fisheries and Game, Augusta 04330. Forestry Dept., Augusta 04330. Geological Survey, Augusta 04330. State Park and Recreation Commission, Augusta 04330. State Soil and Water Conservation Committee, Augusta 04330. Maine Cooperative Fishery Unit, University of Maine, Orono 04473. Maine Cooperative Wildlife Research Unit, University of Maine. Governor's Conference on Natural Beauty, State Park and Recreation Commission.

MARYLAND: Board of Natural Resources, Annapolis 21401. Dept. of Chesapeake Bay Affairs, Annapolis 21404. Dept. of Forests and Parks, Annapolis 21404. Dept. of Game and Inland Fish, Annapolis 21404. Dept. of Water Resources, Annapolis 21404. Geological Survey, The Johns Hopkins University, Natural Resources Institute of the University of Maryland, College Park 20740. State Board of Agriculture, University of Maryland. State Dept. of Health, Baltimore 21201. State Soil Conservation Committee, University of Maryland. Governor's Conference on Recreation and Parks, State Office Bldg., Annapolis.

MASSACHUSETTS: Assoc. of Conservation Commissions, 84 State, Boston 02108. Dept. of Agriculture, Boston 02202. Dept. of Education, Boston 02111. Dept. of Natural Resources, Boston 02202. Dept. of Public Health, Boston 02133. Division of Fisheries and Game, Boston 02202. Division of Waterways, Boston 02114. Metropolitan District Commission, Boston 02108. State Committee for Soil, Water and Related Resources, Dept. of Natural Resources. Massachusetts Cooperative Fishery Unit, University of Massachusetts, Amherst 01002. Massachusetts Cooperative Wildlife Research Unit, University of Massachusetts. Governor's Conference on Natural Beauty, State Office Bldg., Boston 02202.

MICHIGAN: Dept. of Agriculture, Lansing 48913. Dept. of Natural Resources, Lansing 48926. Dept. of Public Health, Lansing 48914. Huron-Clinton Metropolitan Authority, 1750 Guardian Bldg., Detroit 48226. Water Resources Commission, Station A, Lansing 48926. Governor's Conference on Natural Beauty, Dept. of Conservation, Lansing.

MINNESOTA: Dept. of Agriculture, St. Paul 55101. Dept. of Conservation, St. Paul 55101. Geological Survey, University of Minnesota, Minneapolis 55455. Pollution Control Agency, University Campus, Minneapolis 55440. State Soil and Water Conservation Committee, University of Minnesota, St. Paul 55101. Water Resources Board, St. Paul 55101. Governor's Conference on Keeping Minnesota Green and Scenic, Dept. of Conservation.

MISSISSIPPI: Air and Water Pollution Control Commission, POB 827, Jack-

son 39205. Dept. of Agriculture and Commerce, Jackson 39205. Forestry Commission, Jackson 39201. Game and Fish Commission, Jackson 39205. Gulf Coast Research Laboratory, E. Beach, Ocean Springs 39564. Park System, Jackson 39201. State Board of Health, Jackson 39205. State Board of Water Commissioners, Jackson 39201. State Soil Conservation Committee, Extension Bldg., State College 39762. Beautification: Park System, Jackson 39201.

MISSOURI: Dept. of Agriculture, Jefferson City 65101. Dept. of Conservation, Jefferson City 65101. Division of Geological Survey and Water Resources, Rolla 65401. State Park Board, Jefferson City 65101. State Soil and Water Districts Commission, University of Missouri, Columbia 65201. Water Pollution Board, Dept. of Public Health and Welfare, Jefferson City 65101. Missouri Cooperative Fishery Unit, University of Missouri. Missouri Cooperative Wildlife Research Unit, University of Missouri. Governor's Conference on Natural Beauty, Jefferson City 65101.

MONTANA: Bureau of Mines and Geology, Montana College of Mineral Science and Technology, Butte 59701. Dept. of Agriculture, Helena 59601. Dept. of State Lands and Investments, Helena 59601. Fish and Game Dept., Helena 59601. Office of State Forester, Missoula 59801. State Department of Health, Helena 59601. State Soil Conservation Committee, Montana College of Mineral Science and Technology. State Water Resources Board, Helena 59601. Montana Cooperative Fishery Unit, Montana State University, Bozeman 59715. Montana Cooperative Wildlife Research Unit, University of Montana, Missoula 59801. Beautification: Dept. of Fish and Game, Helena 59601.

NEBRASKA: Dept. of Agriculture, Lincoln 68509. Dept. of Health, Lincoln 68509. Dept. of Water Resources, Lincoln 68509. Game and Parks Commission, Lincoln 68509. Geological Survey, University of Nebraska, Lincoln 68508. State Soil and Water Conservation Commission, Lincoln 68509. Governor's Council to Keep Nebraska Beautiful, Game and Parks Commission, Lincoln 68509.

NEVADA: Bureau of Environmental Health, Reno 89502. Bureau of Mines, University of Nevada, Reno 89507. Dept. of Agriculture, Reno 89504. Dept. of Conservation and Natural Resources, Carson City 89701. Fish and Game Commission, Reno 89910. State Park Advisory Commission, Carson City 89701. State Park System, Carson City 89701. State Soil Conservation Committee, College of Agriculture, Reno 89701. Governor's Beautify Nevada Committee, Dept. of Conservation and Natural Resources, Carson City 89701.

NEW HAMPSHIRE: Dept. of Agriculture, Concord 03301. Dept. of Resources and Economic Development, Concord 03301. Fish and Game Department, Concord 03301. State Conservation Committee, Concord 03301. Water Resources Board, Concord 03301. Water Supply and Pollution Control Commission, Concord 03301. Governor's Conference on Natural Beauty, Concord 03301.

NEW JERSEY: Bureau of Geology and Topography, POB 1889, Trenton 08625. Dept. of Agriculture, Trenton 08625. Dept. of Conservation and Economic Development, Labor and Industry Bldg., Trenton 08625. State Department of Health, Trenton 08625. State Soil Conservation Committee, Dept. of Agriculture. Governor's Conference on Natural Beauty, POB 1390, Trenton 18625.

NEW MEXICO: Dept. of Agriculture, Las Cruces 88001. Dept. of Fish and Game, Santa Fe 87501. Dept. of State Forestry, Santa Fe 87501.

State and Social Services Dept., Santa Fe 87501. State Bureau of Mines and Mineral Resources, Campus Station, Socorro 87801. State Engineer Office-Interstate Stream Commission, Santa Fe 87501. State Park and Recreation Commission, Santa Fe 87501. State Soil Conservation Committee, Santa Fe 87501. Governor's Conference on Environmental Health Planning, Santa Fe 87501.

NEW YORK: Conservation Dept., Albany 12226. Dept. of Agriculture and Markets, Albany 12226. Geological Survey, Albany 12224. Natural Beauty Commission, Albany 12208. State Fish and Wildlife Management Board, Albany 12226. State Soil and Water Conservation Committee, Cornell University, Ithaca 14850. New York Cooperative Fishery Unit, Cornell University. New York Cooperative Wildlife Research Unit, Cornell University. Governor's Conference on Natural Beauty, Office for Local Government, Albany 12224.

NORTH CAROLINA: Dept. of Agriculture, Raleigh 27602. Dept. of Conservation and Development, Raleigh 27602. Dept. of Water and Air Resources, Raleigh 27603. Seashore Commission, Raleigh 27603. State Soil and Water Conservation Comm., North Carolina State University, Raleigh 27607. Wildlife Resources Commission, Raleigh 27602. North Carolina Cooperative Fishery Unit, North Carolina State University. Governor's Conference on Beautification, Dept. of Conservation and Development, Raleigh.

NORTH DAKOTA: Dept. of Agriculture, Bismarck 58501. Dept. of Health, Bismarck, 58501. Geological Survey, University Station, Grand Forks 58201. State Forest Service, School of Forestry and Junior College, Bottineau 58318. State Game and Fish Department, Bismarck 58501. State Park Service, Bismarck 58501. State Soil Conservation Committee, Bismarck 58501. Water Commission, Bismarck 58501. North Dakota State Beautification Conference, Bismarck 58501.

OHIO: Dept. of Agriculture, Columbus 43215. Dept. of Health, Columbus 43216. Dept. of Natural Resources, Columbus 43215. The Miami Conservancy District, Dayton 45402. Muskingum Watershed Conservancy District, New Philadelphia 44663. School of Natural Resources of the Ohio State University, Columbus 43210. Soil and Water Conservation Committee, Ohio State University. Ohio Cooperative Fishery Unit, Ohio State University. Ohio Cooperative Wildlife Research Unit, Ohio State University. Workshop Conference on Natural Beauty, Dept. of Natural Resources, Columbus 43215.

OKLAHOMA: Dept. of Wildlife Conservation, Oklahoma City 73105. Geological Survey, University of Oklahoma, Norman 73069. Industrial Development and Park Department, Oklahoma City 73105. State Board of Agriculture, Oklahoma City 73105. State Board of Health, Oklahoma City 73105. State Soil Conservation Board, Oklahoma City 73105. Oklahoma Cooperative Fishery Unit, Oklahoma State University, Stillwater 74074. Oklahoma Cooperative Wildlife Research Unit, Oklahoma State University. Oklahoma Conference on Community Beauty, Industrial Development and Park Department.

OREGON: Columbia River Gorge Commission, Portland 97232. Dept. of Agriculture, Salem 97310. Dept. of Geology and Mineral Industries, Portland 97201. Fish Commission, Portland 97201. State Board of Health, Portland 97201. State Committee on Natural Resources, Salem 97310. State Engineer, Public Service Bldg., Salem 97310. State Forestry Dept., Salem 97310. State Game Commission, Portland 97208. State Highway Dept., Salem 97310. State Marine Board, Salem 97310. State Sanitary Authority, Portland 97207. State Soil and Water Conservation Committee, Salem 97310. Water Resources Board, Salem 97310.

Oregon Cooperative Fishery Unit, Oregon State University, Corvallis 97113.  
Governor's Conference on Beautiful Oregon, Salem.

PENNSYLVANIA: Dept. of Agriculture, Harrisburg 17120. Dept. of Forests and Waters, Harrisburg 17120. Fish Commission, Harrisburg 17120. Game Commission, Harrisburg 17120. Sanitary Water Board, Dept. of Health, Harrisburg 17120. State Soil and Water Conservation Commission, Harrisburg 17120. Topographic and Geologic Survey, Dept. of Internal Affairs, Harrisburg 17120. Pennsylvania Cooperative Fishery Unit, Pennsylvania State University, University Park 16802. Pennsylvania Cooperative Wildlife Research Unit, Pennsylvania State University. Governor's Conference on Natural Beauty, Dept. of Forests and Waters, Harrisburg 17105.

RHODE ISLAND: Association of Conservation Commissioners, Lincoln. Dept. of Health, Providence 02903. Dept. of Natural Resources, Providence 02903. Dept. of Public Works, Providence 02903. Development Council, Providence 02908. State Soil Conservation Committee, Providence 02903. State Water Resources Board, Providence 02907. Governor's Conference on Natural Beauty, Providence 02908.

SOUTH CAROLINA: Dept. of Agriculture, Columbia 29211. Division of Geology, State Development Board, Columbia 29202. Division of Recreation, Dept. of Parks, Recreation and Tourism, Columbia 29202. Pollution Control Authority, State Board of Health, Columbia 29202. State Commission of Forestry, Columbia 29202. State Soil and Water Conservation Committee, Columbia 29201. Water Resources Committee, Columbia 29201. Wildlife Resources Department, Columbia 29202. Governor's Beautification Conference, Dept. of Parks, Recreation and Tourism, Columbia 29202.

SOUTH DAKOTA: Committee on Water Pollution, State Dept. of Health, Pierre 57501. Conservancy District, State Office Bldg., Pierre 57501. Dept. of Agriculture, Pierre 57501. Dept. of Game, Fish and Parks, Pierre 57501. Geological Survey, University of South Dakota, Vermillion 57069. Industrial Development Expansion Agency, Pierre 57501. State Conservation Committee, Pierre 57501. Water Resources Commission, Pierre 57501. South Dakota Cooperative Fishery Unit, South Dakota State University, Brookings 57006. South Dakota Cooperative Wildlife Research Unit, South Dakota State University. Beautification: Dept. of Game, Fish and Parks, Pierre 57501.

TENNESSEE: Dept. of Agriculture, Nashville 37204. Dept. of Conservation, Nashville 37203. Game and Fish Commission, Nashville 37203. State Soil Conservation Committee, Knoxville 37901. Stream Pollution Control Board, Dept. of Public Health, Nashville 37219. Beautification: C2-208 Central Services Bldg., Nashville 37219.

TEXAS: Bureau of Economic Geology, University Station, Austin 78712. Dept. of Agriculture, Austin. Forest Service, College Station 77841. General Land Office, Library and Archives Bldg., Austin 79101. Parks and Wildlife Dept., Austin 78701. State Dept. of Health, Austin 78756. State Soil and Water Conservation Board, Temple 76501. Water Quality Board, Austin 78701. Water Rights Commission, Austin 78711. Our Environmental Crisis Conference, Parks and Wildlife Department, Austin 78701.

UTAH: Dept. of Agriculture, Salt Lake City 84114. Geological and Mineralogical Survey, University of Utah, Salt Lake City 84112. State Dept. of Natural Resources, Salt Lake City 84114. State Division of Health,

Salt Lake City 84113. State Soil Conservation Committee, Salt Lake City 84114. Utah Cooperative Fishery Unit, Logan 84321. Utah Cooperative Wildlife Research Unit, Utah State University. Beautification: Dept. of Natural Resources, Salt Lake City 84114.

VERMONT: Dept. of Agriculture, Montpelier 05602. Dept. of Forests and Parks, Montpelier 05602. Dept. of Health, Burlington 05401. Dept. of Water Resources, Montpelier 05602. Fish and Game Dept., Montpelier 05602. Geological Survey, University of Vermont, Burlington 05401. Recreation Dept., Montpelier 05602. State Natural Resources Conservation Council, University of Vermont. Governor's Conference on Natural Beauty, Central Planning Office, 118 State St., Montpelier.

VIRGINIA: Commission of Game and Inland Fisheries, Richmond 23213. Dept. of Conservation and Economic Development, Richmond 23219. Dept. of Health, 23219. Institute of Marine Science, Gloucester Point 23026. Marine Resources Commission, P. O. Box 756, Newport News 23607. Northern Virginia Regional Park Authority, 10680 Main St., Fairfax 22030. Resource-Use Education Council, Virginia Polytechnic Institute, Blacksburg 24061. State Water Control Board, Richmond 23230. Virginia Cooperative Fishery Unit, Virginia Polytechnic Institute, Blacksburg 24061. Virginia Cooperative Wildlife Research Unit, Virginia Polytechnic Institute. Governor's Conference on Natural Beauty, Richmond 23219.

WASHINGTON: Dept. of Agriculture, Olympia 98501. Dept. of Fisheries, Olympia 98501. Dept. of Game, Olympia 98501. Dept. of Natural Resources, Olympia 98501. Dept. of Water Resources, Olympia 98501. State Parks and Recreation Commission, Olympia 98501. Water Pollution Control Commission, Olympia 98501. Washington Cooperative Fishery Unit, University of Washington, Seattle 98105. Design for Washington Conference, 312 First Ave., N., Seattle 98109.

WEST VIRGINIA: Dept. of Agriculture, Charleston 25305. Dept. of Natural Resources, Charleston 25305. Geological and Economic Survey, Box 879, Morgantown 26505. Oglebay Institute, Oglebay Park, Wheeling 26003. Keep West Virginia Beautiful Conference, State Capitol, Charleston 25305.

WISCONSIN: Dept. of Agriculture, Madison 53702. Dept. of Natural Resources, Madison 53701. Geological and Natural History Survey, University Extension, University of Wisconsin, Madison 53706. Soil Conservation Board, University of Wisconsin. Governor's Conference on Natural Beauty, Box 450, Madison 53701.

WYOMING: Dept. of Agriculture, Cheyenne 82001. Game and Fish Commission, Cheyenne 82001. Geological Survey, University of Wyoming, Laramie 82070. Natural Resources Board, Cheyenne 82001. State Board of Land Commissioners, Cheyenne 82001. State Dept. of Public Health, Cheyenne 82001. State Forestry Division, Cheyenne 82001. Governor's Conference on Outdoor Recreation and Natural Beauty, State Office Bldg., Cheyenne.

# The Oceans and You

## EMPLOYMENT POSSIBILITIES WITH PRIVATE INDUSTRY

In looking at career possibilities with private firms in oceanography, you quickly discover an essential fact -- the marine field is diverse.

It is difficult to generalize about employment prospects in the private field. The conditions which will permit offshore petroleum to grow or which will curtail it are peculiar to that endeavor and may have little if anything to do with the future health of the American fishing industry, for instance.

What we have assembled in this section, therefore, are statements about employment opportunities now and as they are foreseen for a variety of individual companies. The firms were selected to give you a picture of the range of types of companies involved with the oceans and coastal areas to one degree or another.

The range is from a small, specialty equipment manufacturer to a large petroleum production company. There are firms dependent on contract work with the Federal Government and others with little or no such work.

From this small sample of the many private enterprises working with the oceans we hope to give you some feel for what employment prospects are really like today and what may be ahead.

Keep in mind that this is a young and changing field. Innovative developments -- such as offshore and nuclear plants or offshore airports -- could catch on as practical solutions to environmental and land-use problems facing coastal cities. Such a development would enhance employment prospects for firms involved in such enterprises dramatically.

There are a number of lists of private firms involved in oceanography. These lists tend to understate the offshore petroleum component and commercial fishing; an excellent source of information about the former field is the American Petroleum Institute, Committee on Public Affairs, 1801 K Street, N.W., Washington, D.C. 20036. For information on fishing write the National Fisheries Institute, 1225 Connecticut Avenue, N.W., Washington, D.C. 20036.

Useful directories which list and/or describe private firms in the field are:

1. Oceanography Information Sources '70, \$2.50, Printing and Publications Office, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.
2. UnderSea Technology Handbook and Directory, 1971-72, \$12.50, Compass Publications, Inc., 1117 North 19th Street, Arlington, VA 22209, possibly available in libraries of government agencies, major industries with marine activities. (Revision due spring, 1973).

AUTOMATION INDUSTRIES, INC.  
VITRO LABORATORIES DIVISION

Vitro Laboratories Division, Silver Spring, Maryland, is an engineering services company which provides systems level engineering and program management support to customers. The exact nature of services varies from customer to customer and program to program, but an almost complete range and depth of engineering, scientific, analytical and management capabilities resides within the 3,200-person staff.

In addition to the approximate 750-person staff of engineers and scientists, Vitro Laboratories maintains and operates a full capability (commercial and scientific) computer complex, one of the largest documentation and printing facilities in the mid-Atlantic region, a mechanical and electronic development and production facility and an in-house research and development effort.

Vitro Laboratories' marine activities are largely centered in support of the U. S. Navy programs. Normally, Vitro personnel augment the staff of the project manager and perform discreet tasks of an unlimited variety. Examples of some of these tasks are:

- Engineering and analytical verification and quantification of systems performance requirements resulting in functional system level design
- Preparation and maintenance of principal program documentation including:
  - specifications
  - management and technical planning documents
  - engineering drawings and systems documentation
  - systems integration, test and checkout and evaluation documentation
- Evaluation of proposed hardware procurements
- Technical and management monitoring of hardware contractors
- Preparation and implementation of systems interface procedures
- Preparation and conduct of systems test and evaluation procedures
- Development of integrated logistics systems for life cycle support
- Life cycle engineering and management support to user activities

Significant programs for which Vitro Laboratories has provided the aforementioned services have included the ballistic missile submarine programs, surface missile systems ships programs, coastal hydrographic survey ship system program, anti-submarine warfare programs, and the wire-guided torpedo program.

Vitro Laboratories employs virtually all types of engineering and scientific disciplines. The majority of engineers are either electrical or mechanical engineers. Physicists and mathematicians comprise the

majority of scientific personnel. Specialization is significant in the majority of scientific efforts, whereas broad background experience in engineering efforts is considered most important. Total comprehension of any subject (cause and effect, both within and without) along with practical experience and the ability to apply this intelligence to a particular program is placed at a premium for the work performed by Vitro Laboratories.

#### EXXON

Exxon, known until January, 1973 as Humble Oil & Refining Company, Houston, Texas, is the principal domestic affiliate of the Standard Oil Company of New Jersey. The major interests of Exxon are connected with locating, producing, transporting, refining, and marketing petroleum products. Most of Exxon's activities are concentrated in the coastal zone, with increasing interest and emphasis being placed on the oceans.

The demand for energy in the United States is expected to continue at an average annual growth rate 4.2 percent over the next ten years. Petroleum in the form of oil and gas will continue to supply some two-thirds of this demand, with the offshore areas expected to increase its current share from around 15 percent to 30 percent or more by 1985.

The petroleum industry, as well as various petroleum supply and support industries, should continue to need several types of marine-oriented individuals during the short term to intermediate term future. Since petroleum is formed in association with marine sedimentary rocks of either a carbonate or clastic origin, there will be a continuing but decreasing need for petroleum geologists. There may be a small demand for geological oceanographers to study in situ sedimentary processes as one means of better understanding the geologic past.

A slightly greater demand should occur in the field of ocean and environmental engineering. Individuals within this occupation will solve the problems associated with such items as offshore and nearshore platforms, subsea completion units, pipelines, and terminals. While the nucleus of knowledge for these jobs will be the same as for any engineering job, the ocean engineer must have a thorough understanding of the inter-relationship of the forces, mechanisms, and conditions of the local marine environment and ecosphere.

The greatest growth and demand in terms of both percentages and numbers will probably occur in the category loosely entitled marine technician. The level of education desirable for this field would range from high school through a baccalaureate or beyond. The common denominator for this category is instrumentation or hardware of some sort normally in conjunction with a vessel. Examples of occupations in this category include ship engineers, deckhands, divers, underwater welders, underwater communication and remote sensing specialists, and scientific data gatherers.

Ancillary to these major categories just described, there will be a need in the offshore petroleum industry for a small number of individuals in the fields of medicine, law, ecology, marine management, and government relations, among others. These jobs will require at least one college degree, preferably two.

#### GLOBAL MARINE INC.

Virtually everything Global Marine Inc. does involves the oceans -- offshore oil and gas drilling, deep sea mining, deep sea scientific drilling,

coastal engineering, water quality studies, arctic offshore operations, oceanography, etc.

We are well known to the general public for our participation in the Deep Sea Drilling Project, funded by the National Science Foundation. Global Marine designed, built and operates the GLOMAR CHALLENGER, the advanced deep ocean research drilling ship whose scientific discoveries have strongly supported the continental drift theory and made other contributions to basic knowledge of our planet. The GLOMAR CHALLENGER has drilled into the ocean floor under four miles of water, and has withdrawn a drill and re-entered the drill hole under 2.5 miles of water. Both these accomplishments reflect important technological breakthroughs.

We are currently developing technology for deep ocean mining of minerals. The key element in the deep ocean mining system is a 600-foot prototype vessel now under construction. The specialized ship will displace approximately 35,000 tons and will accommodate a crew of more than 100. It is scheduled to begin operations late in 1973 or early in 1974.

For work in the arctic, we are developing an air cushion drilling and transportation system which will be able to operate nearly year around. This new capability should sharply accelerate petroleum exploration and recovery in the arctic.

Other Global Marine activities include oceanographic services such as ice movement studies and wave and current studies; oceanic services such as marine architecture and engineering related to ocean structures; and aquaculture research to develop methods for commercially growing shrimp and other sea food.

We do all these things in addition to our main business, which is offshore drilling for oil and development of offshore oil fields.

Because of these multi-faceted interests, our employment needs encompass a wide range of scientific and engineering disciplines, not just oceanography per se. Important employment categories include but are not limited to naval architects, structural engineers, geologists, meteorologists, mathematicians, civil engineers and electrical engineers. As we continue to diversify and grow as a company, we expect our employment opportunities will continue to expand.

Of course, it would be useful for people wishing to work for Global Marine to have some knowledge of the oceans and their unique problems. But the important thing is to have a solid foundation in the basic disciplines. Adaptations for ocean-related work can be learned through on-the-job experience.

#### PLESSEY ENVIRONMENTAL SYSTEMS

Plessey Environmental Systems, San Diego, CA -- The technical and professional personnel we employ fall into two broad categories, i. e., engineer trained and scientifically trained. The former includes mechanical and electronic engineers who have, or acquire during employment with us, experience with instrument development techniques peculiar to the ocean environment. The latter category encompasses the scientific disciplines of physics, chemistry, biology and geology. Education levels range from high and trade school completion for technicians to B. S., M. S., and Ph. D. levels in the engineering and scientific categories.

Our current employment is 65 people, 16 of which are technical staff

with nine of these holding college degrees.

At the present time our employment outlook is static and no hiring is being done. Over the next five years we estimate our staff could double in all categories.

Unquestionably, we find actual oceanographic field experience to be the most useful background for incoming employees -- including those we might seek for marketing and other business functions. In this business, obtaining such experience as part of the educational process seems invaluable. I would suggest that a kind of apprenticeship period with an oceanographic or marine research institution after graduation would be most useful to those contemplating specialization in marine engineering or science.

#### RAYTHEON COMPANY

Raytheon is a multi-division company whose 1971 sales ranked it 88th on the "Fortune 500" list. Over 46,000 employees are located in plants around the country with a large number employed in New England.

Raytheon's business is divided among 16 operating divisions which are engaged in a wide variety of commercial and governmental product and service areas. To show the diversity: The Microwave and Power Tube Division supplies electron devices and components; United Engineers and Constructors is engaged in industrial plant design; Amana Refrigeration is a leader in that field; Missile Systems Division contributes to the national defense; D. C. Heath and Company prepares scientific textbooks and educational programs. Uniting these and the other divisions is a background of high technology. Employees of each division share in a uniform and outstanding program of employee benefits.

Raytheon's marine activities include: commercial ship and small craft marine electronic products produced by the Marine Products Division; marine geophysical exploration and radio location services provided by the Seismograph Service Corporation; and a wide spectrum of military equipment and systems activities such as radar and sonar systems provided by several divisions.

Of particular interest is a growing scientific and industrial oceanographic and environmental systems activity through the Ocean and Environmental Systems Centers located in Portsmouth, Rhode Island. These two centers concentrate on products, systems, and services for:

- Describing the ocean bottom and sub-bottom through the application of advanced acoustics and signal processing techniques
- Communicating with and controlling underwater equipment such as subsea oil and gas drilling and production systems utilizing acoustics
- Displaying and storing data with graphic recording equipment
- Measurement of fluid flow, sound velocity, and density interfaces by acoustic techniques
- Detecting and locating underwater objects acoustically

- Measuring, processing, storing and displaying information which describes the physical, chemical and biological condition of the marine environment
- Providing water-quality monitoring instrumentation
- Controlling waste treatment plants
- Displaying the synoptic status of the marine environment over a wide geographic area
- Advising potential polluters of the existing or probable environmental impact of present or proposed systems

Personnel needs include technological, management, and marketing talent at all levels in the following fields:

electronic engineering, acoustics, mechanical engineering, geophysics, geology, sedimentology and marine soil mechanics, geodesy, physical oceanography, marine biology, chemistry, ecology and mathematics.

#### WESTINGHOUSE OCEAN RESEARCH AND ENGINEERING CENTER

The Ocean Research and Engineering Center, Oceanic Division of Westinghouse, Annapolis, Maryland, is interested and involved with the field of ocean engineering and its many facets. It is a profit center of the Westinghouse Corporation and as such carries out the function of providing products and services to the customer with orderly return on investments of the resources made available to us. These resources come from both our company and customer contracts, and from the technical people we employ.

The purpose of the center is to provide excellence in technology, with products reflecting state-of-the-art from an engineering aspect with emphasis upon reliability of performance with the environment involved. Efforts are concentrated in three basic fields of activities which are referred to as core technologies:

1. Information Systems: Concentrates on sensors such as various sonars and underwater optics to penetrate the medium of water. The data received are handled in many ways to provide a display, or tape, or information required to satisfy the performance as advertised of the system.
2. Life Support Systems: Essentially, man-in-the-water; the diving equipment and the life sustaining equipment needed within the sea environment and at depths. Many technical spin-offs are being found which can be applied to similar performance in other types of environments.
3. Vehicles Technology: Involves conceptual studies, system analysis, design, construction, and operation of equipment that moves in the ocean environment. This includes submarines and manned vehicles which provide instrument platforms to obtain data for purposes of exploration, survey, detection, classification of objects in the environment.

Independent research and development programs are all focused to support the above mentioned core technologies carried out by this division. Close contact with the customer and the corporate research and development laboratories is an essential part of the operation.

The management is optimistic that ocean sciences will provide unlimited opportunities in the future to meet specific needs of social, economic and statutory requirements, not only of the United States but of the world. It is the aim of this management to have the knowledge and equipment which will provide the services when needed and under economic realities for the customer -- whoever it may be. It is recognized that several programs envisioned by the marine industry have not materialized as rapidly as expected in the late '60's. However, in the decade of the '70's, considerable progress is expected to be made as Federal, State and industrial programs become defined, funded, and executed. Many of the technologies developed under defense programs will become apparent in commercial ventures whether they be exploration or exploitation, or even conservation of the numerous natural resources within our boundaries.

The Oceanic Division is generally in search of people with Bachelor's degrees or above in electrical and mechanical design, systems engineering and naval architecture. For more specialized areas, limited numbers of people are required in the fields of oceanography (applied and theoretic), marine biology, geology, chemistry, physics, and materials engineers are also required in limited numbers. Persons with degrees or advanced degrees in Economics, Business, Finance, Law, and/or Cost Accounting are also quite desirable in this field.

Non-degreed technicians in life support, materials and processing, drafting are most essential and quite desirable. Also, a crying need exists for electrical technicians and model shop machinists.

# The Oceans and You

## EMPLOYMENT POSSIBILITIES WITH UNIVERSITIES

The academic community is another major employment center for persons interested in ocean careers. We have sampled several universities with major marine programs in order to give both a suggestion about the range of those programs and an indication of the employment prospects.

It is clear from these presentations that jobs at the universities and in the research laboratories are restricted in number and generally available for persons with advanced degrees. Technicians likewise may be required to have considerable higher education to be considered at these installations, as at the Scripps Institution of Oceanography, a graduate facility of the University of California at San Diego.

(For an illuminating portrayal of the types of persons who work at the universities and in labs, and the type of work they perform, read "The New World of the Oceans Men in Oceanography" by Daniel Behrman, Little, Brown & Co., 1969.)

The conditions for employment described in this section are representative of the large institutions active in the marine field around the country. For precise information, contact the institutions directly, using the curricula listing included in this booklet.

## UNIVERSITY OF RHODE ISLAND

The Graduate School of Oceanography (GSO), located on the 165-acre Narragansett Bay campus about six miles from the main campus in Kingston, Rhode Island, was established in 1961. It has about 30 faculty members and 130 graduate students, working on M.S. or Ph.D. degrees. It is anticipated that about one faculty member will be added to the staff each year over the next five years; each person who joins the faculty must have a doctoral degree that will qualify him to teach and research in biological, chemical, physical, or geological oceanography. For each new faculty member, about five more graduate students can be accepted. There are about four support personnel, including technicians, administrators, guards, janitors, and so forth, for each faculty member at the GSO. About half the support personnel are technicians or research associates and have training that ranges from a bachelor's degree in science to a doctoral degree. Qualifications of other support personnel are, of course, mixed. The GSO administers a marine experiment station as a base of operation for research in aquaculture, fishing gear and fish population dynamics.

The University's graduate department of ocean engineering has about 88 graduate students, of which about two-thirds are studying for master's degrees and one-third for doctorates. The department has 14 faculty members, five of whom are full time; the remaining faculty members are shared with other engineering departments at URI. The department has enjoyed a spurt of growth since it was first established in 1966 with eight graduate students. Growth will now be increasing more slowly. Increases depend on the number of students and the number of students depends on the amount of money available to support

them. New faculty members will be expected to have doctoral degrees. With the new ocean engineering facility being built on the Narragansett Bay campus, it is expected that there may be a few openings for non-student research assistants. That classification currently includes two researchers, a diving officer and the captain of the department's research vessel.

A doctoral degree program in economics with a marine resource option is offered jointly by the department of resource economics of the College of Resource Development, the department of economics in the College of Arts and Sciences, and the department of finance of the College of Business Administration. Fifteen students are presently enrolled in the program.

A Master of Marine Affairs program, the first of its kind in the country, is a multidisciplinary effort of the departments of resource economics, geography, geology, ocean engineering, political science, and the Graduate School of Oceanography. It accepts a maximum of 20 students each year to train them to make decisions about the oceans and coastal policy in government and industry.

At the undergraduate level, the department of fisheries and marine technology offers a two-year commercial fisheries program leading to an associate in science degree. About 30 students are presently enrolled. Undergraduate mechanical and chemical engineering students will be able to graduate with an ocean engineering option. Under the plan, mechanical or chemical engineering students will be able to take the joint program in their senior year. An intensive series of courses will introduce the students to the design of ocean systems, estuarine pollution and water quality, theories of underwater acoustics, and the operation of instruments and gear from research vessels.

In addition, nearly every science-oriented discipline at the University has some marine specialization at the graduate level. More than 100 scientists--about one-seventh of the entire faculty--are engaged in marine-oriented research. Of particular interest is the marine pharmacology-pharmacognosy program in the College of Pharmacy.

As a Sea Grant college, URI has a public service function. The Marine Advisory Service provides field services in fisheries, marine economics, education and coastal development and management. Unlike most faculty researchers, employees of the advisory service do not necessarily have doctorates. About eight persons are currently employed by the advisory service.

The New England Marine Resources Information Program, which has URI as its location, disseminates marine information on a regional basis, primarily through publications in such areas as aquaculture, water pollution and coastal studies. NEMRIP and the advisory service are staffed and administered by the same people.

The Law of the Sea Institute serves as a kind of clearinghouse for information on international, regional and local marine law. Other marine-related programs at URI include the International Center for Marine Resource Development, the Water Resources Center, the Institute of Environmental Biology and the Marine Resources Program.

A Coastal Resources Center was established at the University in 1971 to help the state plan the uses and manage the resources of its coastal region. Plans call for the organization of a small technical and professional staff that would be able to handle both short-term and long-term planning for Narragansett Bay and other Rhode Island waters.

The Graduate School of Oceanography's research vessel, Trident, employs a crew of about 20 men. It has an annual turnover rate of about five crewmen. The potential for expansion of employment in this area is slight.

## OREGON STATE UNIVERSITY

The university has broad programs of research, teaching, and extension work in marine affairs. Funding sources include Sea Grant which is the largest single source, National Science Foundation, Office of Naval Research, National Marine Fisheries Service, and many others, including substantial state support. Programs are conducted in Corvallis, Eugene, Astoria, Netarts Newport, and Port Orford. The discipline areas involved include agricultural economics, botany, engineering, fisheries, food science and technology, microbiology, oceanography, and zoology. In addition, major participants in the marine program are the university's extension for the ocean, the Marine Advisory Program, and the University of Oregon School of Law, at Eugene. Clatsop Community College is a participant in the Oregon Sea Grant Program.

Because this is an educational and research institution, it usually required its employees to have at least a bachelors degree. Typically, technicians will have achieved the bachelors level. Of course, advanced degrees are expected commensurate with the individual research, teaching, and extension responsibilities involved.

Following is a breakdown of current employment by subject area:

### Agricultural economics (Department of)

Positions: 12 faculty members involved at least part-time  
3 half-time research assistants  
Comments: Equivalent to about four full-time positions

### Botany (Department of)

Positions: 2 faculty members involved at least part-time  
Comments: (See Zoology)

### Ocean engineering (in School of Engineering)

Positions: 8 faculty members involved at least part-time  
Some research assistants employed  
Comments: Numbers vary

### Fisheries (Department of Fisheries and Wildlife)

Positions: 2 professors  
5 associate professors  
Comments: No positions open now, opening anticipated 1972-73

### Food Science (Department of Food Science and Technology)

Positions: 32 positions involved at least part-time, including faculty, graduate assistants, and Civil Service

### Law (University of Oregon School of Law, Eugene)

Positions: 1 faculty  
3 graduate research assistants

### Marine Advisory Program (Extension)

Positions: 10 faculty positions and 1 Civil Service  
Comments: Specialties include oceanography, food technology, economics, information, fisheries, marine science education

Microbiology

Positions: 3 faculty members  
4 research assistants  
19 graduate students

Oceanography

Positions: 52 faculty members, administrators, research associates  
63 technical staff members  
30 Civil Service employees  
Comments: Includes - 11 biological oceanographers, 3 chemical oceanographers, 9 geological oceanographers, 3 geophysicists, 16 physical oceanographers, 5 radioecologists  
Opportunities for employment are limited

Zoology

Positions: 3 faculty members  
1 research associate  
Comments: 1 additional faculty member in Department of General Science is involved with marine work

TEXAS A&M UNIVERSITY

Texas A&M University is located in College Station, Texas, approximately 150 miles from the Gulf of Mexico. In 1876 the university received a land grant designation and recently was designated one of six Sea Grant Colleges. Originally established as a mechanical and agricultural college, the university has developed into a broad-based institution with undergraduate and graduate degrees in ten colleges.

Accompanying Texas A&M University's rapid academic expansion has been the development of broad-based marine activities. Following the organization of the Department of Oceanography in 1949, the university has moved forward with comprehensive education research and extension activities in the marine environment. In 1953 the university's Marine Laboratory was established as an interdepartmental institution of Texas A&M. Presently, the university's marine efforts are primarily encompassed around the Gulf of Mexico and its related waterways, estuaries and marshes.

At the present time, undergraduate and graduate degrees in marine science and engineering are offered in 14 departments. Within these 14 degree-offering departments and ten other departments, almost 300 courses are offered dealing with various aspects of marine science, engineering, law, commerce and government. Listed below are the marine-related degrees offered at Texas A&M University.

Marine Science Programs Offered

<u>Type of Program</u>	<u>Degree or Certificate Available</u>
COLLEGE OF AGRICULTURE	
Food Technology	B. S. , M. S. , Ph. D.
Recreation and Parks	B. S. , M. S. , Ph. D.
Wildlife and Fisheries Sciences	B. S. , M. S. , Ph. D.

#### COLLEGE OF BUSINESS ADMINISTRATION

Marine Resources Management M. S., M. B. A.

#### COLLEGE OF ENGINEERING

Civil Engineering B. S., M. S., Ph. D.  
Environmental Engineering M. S., Ph. D.  
Coastal and Ocean Engineering M. S., Ph. D.

#### COLLEGE OF GEOSCIENCES

Geology B. S., M. S., Ph. D.  
Geography B. S., M. S., Ph. D.  
Meteorology B. S., M. S., Ph. D.  
Oceanography M. S., Ph. D.

#### COLLEGE OF MARINE SCIENCES AND MARITIME RESOURCES

Texas Maritime Academy  
Marine Engineering B. S.  
Marine Transportation B. S.

Moody Marine Institute B. S., M. S., Ph. D.  
Options are being developed in  
biology, engineering, geoscience, etc.  
For information concerning these  
degree programs, contact the Center  
for Marine Resources.

#### COLLEGE OF SCIENCE

Biology  
Botany B. S., M. S., Ph. D.  
Zoology B. S., M. S., Ph. D.

Almost any degree recipient from Texas A&M University might apply his knowledge to the marine field. For example, graduates in veterinary medicine are utilized in fishery work; graduates in electrical engineering are in demand for oceanographic instrumentation and remote sensing; degrees in business administration may be applicable to the marine business field. However, these academic fields exist aside from a demand in marine resources fields, and are not justified primarily on that account.

Although marine-related activities are found throughout the university, three major components can be most easily identified. They are: the College of Marine Sciences and Maritime Resources at Galveston, the Center for Marine Resources and the Department of Oceanography, both located on the College Station campus. The college at Galveston is the location for the Moody Marine Institute, the Texas Maritime Academy and the Coastal Zone Laboratory. It includes a 100-acre tract of land on Pelican Island as well as dock space for Texas A&M University's research vessels. The Department of Oceanography and the Center for Marine Resources will soon move into a new 14-story oceanography-meteorology building at College Station.

A student interested in developing a career in the marine field finds little difficulty at Texas A&M University. Educational and research programs are interdisciplinary and cross the traditional guidelines established. Physical facilities are modern and well-equipped. The new oceanography building on

the main campus, as well as the facilities at Galveston, offer a wide variety of teaching and research facilities for both faculty, staff, and students.

Besides the emphasis on marine science and engineering, the university also operates the Texas Maritime Academy in Galveston. The Maritime Academy's training ship, the Texas Clipper, is one of a few vessels currently being operated with instruction of cadets in the field of maritime commerce.

Included in the fleet of vessels operated by the University are six other research vessels of various sizes and equipped to handle different forms of research in estuarine and coastal waters, ranging to the 165' research vessel, Alaminos, which operates in the Gulf of Mexico, Caribbean, and other deep waters. Modern physical facilities, coupled with broad education and research capabilities, make Texas A&M an institution equipped to educate and train interested students in the various ramifications and complexities of the marine ecosystem.

Many students have the misconception that marine science careers are all glamorous and profitable. The development and collection of research data is seldom glamorous, but entails many hours of often tedious and painstaking labor. Laboratory technician positions generally require a Bachelor of Science degree; higher positions call for higher degrees, i. e. Master of Science and Doctor of Philosophy. Many research technician positions available at universities are filled by graduate students working toward a higher degree. Positions for professionals with higher degrees are at present often difficult to obtain. This is a side of marine science which few students may realize until it is too late. Ask questions about the field which interests you -- preferably of a person actually working in the field. Your investment in both time and money preparing yourself for a marine-oriented career is great enough to warrant careful investigation before making a commitment.

Concerning the marine ecosystem, one thing is certain: The marine environment will be developed and this development will require the utilization of dedicated and competent researchers and technicians. The reclamation of precious minerals and petroleum from sea water and the sea floor, the establishment of offshore complexes, the control of marine pollution, and the development of mariculture for seafoods are all projects which will be realized in the future. The marine frontier awaits students who are interested in the oceans, in marine sciences, in the development of marine resources and in the protection of the marine environment.

UNIVERSITY OF CALIFORNIA, SAN DIEGO  
SCRIPPS INSTITUTION OF OCEANOGRAPHY

Ph. D. 's employed at Scripps on an academic level number about 200. Education budget problems being restrictive in the State of California, very little growth in our academic staff is predicted for the next five years.

However, the outlook for technicians seems to be a little brighter, because funds for their salaries are provided largely by the Federal government through various grant appropriations. Norman Anderson, the person at Scripps who does most of the hiring of marine and electronics technicians, expects a small-scale increase in number, on the order of five to ten persons a year. He also foresees a similar replacement rate.

Mr. Anderson says we generally hire marine technicians with a four-year degree in some branch of science. In other words, it is more important to have a background in chemistry, mathematics, or physics than to know how to operate specialized research equipment.

Electronics technicians are hired without college degrees, but they must have experience and some education in the field which will enable them to go to sea and maintain equipment.

Pay scale for the former group ranges from \$644 per month to start as a Marine Technician I, to a top salary of \$1,100 per month as a Marine Technician IV. Monthly salary for electronics technicians ranges from \$728 to \$1,128.

The size of the Shipboard Computer Group at Scripps is expected to remain the same (unless we add more research vessels to our fleet). However, Lynn Abbott, head of the group, says there will probably be about six replacement openings during the next five years; he bases his prediction on this past five years.

Members of the Shipboard Computer Group must be able to operate and maintain computer equipment at sea, and Mr. Abbott says his employees can expect to be aboard ship for four or five months of every year.

Ideally a person should have a four-year degree in computer science, although an electronics background is sometimes a reasonable substitute. Any experience in electronics and electro-mechanics is valuable.

Monthly salary ranges anywhere from \$728 for a beginning Electronics Technician, to \$1,626 for a Senior Development Engineer.

As a general rule, residents of San Diego fill most of Scripps' job openings, but we do hire persons from outside the area. Anyone seeking employment at Scripps Institution of Oceanography must apply through the Personnel Office of the University of California, San Diego. Scripps is a UCSD graduate school.

#### The Marine Technician's Role:

Under general supervision, the marine technician performs or supervises the collection, measurement and analysis of ocean phenomena and samples at sea and ashore; and performs other related duties as required.

Incumbents perform technical duties in one or more fields of marine investigation, such as Marine Biology, Physical Oceanography, Marine Geology, and Marine Chemistry. The following are examples of typical field assignments:

Performs biological sampling from a research vessel; makes plankton hauls, records results, preserves and labels catch; observes, distinguishes and records number and type of marine fishes, birds and mammals; takes trawls at specified depths, preserves or maintains live biological specimens obtained; takes samples of water and bottom sediment for microbiological study, using specialized sampling equipment; makes measures of productivity; analyzes samples for chlorophyll and other organic constituents.

Performs hydrographic station duties using Nansen bottles and other sampling devices; reads deep-sea reversing thermometers; draws off water samples; makes and records bathythermograph observations on station and underway; makes a continuous temperature-salinity depth record; plots graphs and charts and prepares statistical summaries of data.

Performs geological sampling using specialized corers, dredges, shells and recording equipment; operates and maintains reflective profiling equipment such as arcers and air guns; determines sound velocity and corrections to echo-sounder depth from Matthews tables or from hydrographic data; plots

and contours echo-sounder data on a finished track,

Performs chemical analysis of sea water for oxygen, salinity, phosphates, silicates and other elements; operates equipment for continuous measurement of CO<sub>2</sub> content of air and sea water while underway; maintains shipboard chemical laboratory.

Other related duties typically assigned include; use of electronic navigation equipment such as Loran and Radar; use of underwater diving equipment; use and maintenance of "pinger" for positioning equipment underwater; construction and installation of taut-wire and slack-wire instrument moorings; making and recording weather observations; construction, maintenance calibration and repair of specialized equipment such as magnetometers, arcer and diving equipment; use of deep-sea cameras; maintenance of research logs and other records.

# The Oceans and You

## OCEANOGRAPHY CURRICULA

<u>INSTITUTION</u>	<u>PROGRAMS OFFERED</u>	<u>OFFICE TO CONTACT; SPECIAL FACILITIES</u>
Adelphi University Long Island, New York	M. S. in biology or earth sciences with marine specializations	Dean, Graduate School of Arts and Sciences, Adelphi University, Garden City, Long Island, NY 11530, Operates Institute of Marine Science
University of Alabama Alabama Marine Environ- mental Sciences Consortium, Inc. Bayou La Batre, Alabama	B. S., M. S. and Ph. D. programs offered at 17 instate member institutions	Coordinator, Marine Environmental Sciences Consortium, Inc. Box 6282 University, Alabama 35486
University of Alaska College, Alaska	M. S. and Ph. D. biological, chemical, geological or physical oceanography; M. S. in ocean engineering.	Director, Institute of Marine Science, University of Alaska, College, AK 99701 Operates institute including two marine stations
Alfred University Alfred, New York	Undergraduate degrees in the basic sciences-optionally in conjunction with a major in environmental studies.	Office of Admissions, Alfred University, PO Box 765, Alfred, NY 14802 Affiliated with College Center of the Fingerlakes Consortium.
American University Washington, D. C.	Graduate courses in oceanography	
Anne Arundel Community College Arnold, Maryland	A. A. in ocean engineering technology	Director, Ocean Engineering Technology, Anne Arundel Community College, Arnold, MD 21012
University of Arizona Tucson, Arizona	M. S. and Ph. D. in biology, botany or zoology; M. S. and Ph. D. in geological engineering.	Coordinator, Marine Sciences Dept. of Biological Sciences, University of Arizona, Tucson, AZ 85721 Conducts cooperative program with Univ. de Sonora, Hermosillo, Mexico

Boston University Boston, Massachusetts	Graduate and undergraduate courses in marine geology and coastal environ- ments. M.A. and Ph.D. in marine biology.	Dean, Graduate School, Boston University, 705 Commonwealth Ave., Boston, MA 02215 Operates marine program with courses at Marine Biological Laboratory, Woods Hole
Bowdoin College Brunswick, Maine	Summer course in marine ecology	National Science Foundation Operates small marine station
University of Bridgeport Bridgeport, Connecticut	M.S. in biology	Chairman, Department of Biology, University of Bridgeport, Bridgeport, CT 06602
Bridgewater State College Bridgewater, Connecticut	B.A. in biology, chemistry, earth sciences or physics; M.A. in biology and chemistry	Dean of the Graduate School, Bridgewater State College, Bridgewater, MA 02324 Conducts interdepartmental oceanography program at the undergraduate level
California Institute of Technology Pasadena, California	B.S. in biology; Ph.D. in a biological discipline; M.S. or Ph.D. in environ- mental engineering sciences; also, B.S. M.S. or Ph.D. in several engineering fields within Division of Engineering and Applied Science	Chairman, Division of Biology or Chairman, Division of Engineering and Applied Science, California Institute of Technology, Pasadena, CA 91109 Operates several laboratories
California State College Long Beach, California	B.S. in marine biology	Chairman, Biology Dept., California State College, 6101 E. 7th St., Long Beach, CA 90801
California Polytechnic State University San Luis Obispo, California	B.S. and M.S. in biological sciences; B.S. in agricultural engineering with concentration in mariculture planned	Head, Biological Science Department or Agri- cultural Engineering Department, California Polytechnic State University, San Luis Obispo, CA 93401
California State University, Humboldt Arcata, California	B.S. in oceanography; B.A. and M.A. in biology; B.A. in zoology; B.S. and M.S. in fisheries	Program Leader, Oceanography Humboldt State College, Arcata, CA 95521 Operates marine laboratory at Trinidad

INSTITUTION

California State University  
Sacramento, California

California State University  
San Diego, California

California State University  
San Francisco, California

California State University  
San Jose, California

University of California  
Bodega Marine Laboratory  
Bodega Bay, California

University of California, Davis  
Davis, California

PROGRAMS OFFERED

B.A., B.S., M.A. and M.S. in  
biological sciences; M.S. in Con-  
servation

B.A. in geography; B.A. and B.S. in  
biology, botany, chemistry, geology,  
physics and zoology; B.S. in engineering;  
M.A. in physical science; M.A. and  
M.S. in biology, chemistry, physics;  
M.S. in geology and engineering; Ph.D.  
in chemistry, ecology and genetics

M.A. in biology with marine concentra-  
tion

B.A., B.S., M.S., in geology with  
oceanography concentration; B.A., M.S.  
in chemistry with concentration in  
oceanography

M.A. and Ph.D. in botany, geology and  
zoology from departments at Berkeley  
and Davis

M.S. in food science; M.S. and Ph.D.  
in nutrition and B.S. in wildlife and  
fisheries biology

OFFICE TO CONTACT: SPECIAL FACILITIES

Chairman, Department of Biological Sciences,  
California State University, Sacramento, CA  
95819

Director, Bureau of Marine Sciences, California  
State University, San Diego, CA 92115

Department of Marine Biology, San Francisco,  
CA 94132  
Operates Moss Landing Marine Laboratory with  
four other state colleges

Department of Geology, California State University,  
San Jose, CA 95114  
Participates in Moss Landing Marine Laboratory

Director, Bodega Marine Laboratory, Bodega  
Bay, CA 94923  
Courses at the lab are credited at all University  
of California campuses

Institute of Marine Resources, University of  
California, Davis, CA 95616

Chapman College Orange, California	B. A. in geology and biology, B. S. in biology	Chairman, Division of Natural Science, Chapman College, Orange, Calif. 92666 Operates World Campus Afloat on a former passenger vessel.
Cape Fear Technical Institute Wilmington, North Carolina	A. A. S. in marine technology or marine laboratory science	Director of Marine Operations, Cape Fear Technical Institute, Wilmington, N. C. 28401
Catholic University Washington, D. C.	M. S. E. and Ph. D. in ocean engineering; M. S. E. and Ph. D. in engineering acoustics and B. S. E. with ocean en- gineering option	Institute of Ocean Science and Engineering, Catholic University, Washington, D. C. 20017
Charles County Community College La Plata, Md 20646	A. A. in Estuarine Resources Technology	Chairman, Estuarine Resources Technology, Dept. of Biology, Charles County Community College, Box 910 La Plata, Md 20646
Clark University Worcester, Massachusetts	B. A., M. S. and Ph. D. in biology. Graduate degrees with marine con- centrations	Chairman, Department of Biology, Clark University, Worcester, MA 01610
City College of the City University of New York New York, New York	B. A., M. A. and Ph. D. in basic science fields with oceanography concentration	
Clatsop Community College Astoria, Oregon	Associate degrees in marine, oceano- graphic and commercial fishing technology	Dean of Students, Clatsop Community College, Clatsop, OR 97103
Columbia University New York, New York	Ph. D. in geology and biology	Chairman, Department of Geology, Columbia University, New York, NY 10027 Operates Lamont-Doherty Geological Observatory at Palisades, NY 10964
University of Connecticut Storrs, Connecticut	M. S. and Ph. D. in biology, geophysics, geology, oceanography or engineering	Director, Marine Sciences Institute, Avery Point, Groton, CT 06340 or Asst. Director Marine Sciences Institute, Noank, CT 06340

INSTITUTION

✓ Cornell University  
Ithaca, New York

✓ University of Delaware  
Newark, Delaware

Del Mar College  
Corpus Christi, Texas

✓ Duke University  
Durham, North Carolina

✓ Florida Atlantic University  
Boca Raton, Florida

✓ Florida Institute of  
Technology  
Melbourne, Florida

PROGRAMS OFFERED

A. B. in biology, chemistry, physics and geology; B. S. in biology and engineering; M. S. in biology, chemistry, physics, geology and engineering; M. Engineering and Ph. D. in biology, chemistry, physics, geology and engineering. all offer marine specialization

M. S., M. S., and Ph. D. in marine studies with specialization in marine biology, marine geology, chemical oceanography, physical oceanography, marine affairs, and applied ocean science. Recommend that baccalaureate degree be in the area of the student's interest.

A. A. S. in marine science technology

M. A. and Ph. D. in botany and zoology with marine concentration; M. A. or B. S. in geology with oceanography emphasis

M. S. and B. S. in biological sciences, M. S. and B. S. in engineering with major in ocean engineering

B. S. in oceanography with option in biological or physical oceanography; M. S. in oceanography with bio-environmental science or physical oceanography option.

OFFICE TO CONTACT: SPECIAL FACILITIES

Water Resources and Marine Sciences Center, 468 Hollister Hall, Cornell University, Ithaca, New York 14850 Offers introductory summer course in marine science

Dean, College of Marine Studies, University of Delaware, Newark, DE 19711 Operates Field Station at Lewes; summer program for upper level undergraduates and graduates; interdisciplinary studies stressed.

Registrar, Del Mar College  
Corpus Christi, TX 78404

Dean of the Graduate School, Duke University, Durham, NC 27706 Operates marine laboratory at Beaufort, NC

Chairman, Department of Biological Sciences or Department of Ocean Engineering, Florida Atlantic University, Boca Raton, FL 33432

Head, Department of Oceanography, Florida Institute of Technology, Melbourne, FL 32901

<p>Florida Institute of Technology Hydrospace Technical Institute (a division of Florida Institute of Technology) Cocoa Beach, Florida</p>	<p>A. S. in oceanographic technology, marine science technology or ocean- ographic electronic technology and bachelor of oceanographic technology (B. O. T.)</p>	<p>Director, Hydrospace Technical Institute 5505 N. Atlantic Ave., Cocoa Beach, FL 32931</p>
<p>Florida State University Tallahassee, Florida</p>	<p>B. A. and B. S. in biological sciences and meteorology; M. S. and Ph. D. in marine biology; M. S. and Ph. D. in oceanography; Ph. D. in geophysical fluid dynamics</p>	<p>Chairman, Department of Oceanography, Florida State University, Tallahassee, FL 32306</p>
<p>Florida Keys Community College Key West, FL 33040</p>	<p>A. S. Marine Propulsion Technology; A. S. in environmental marine science; A. A. in biology</p>	<p>Registrar, Florida Keys Community College Key West, FL 33040</p>
<p>University of Florida Gainesville, Florida</p>	<p>Departments of botany, microbiology, zoology and biochemistry offer marine courses; five engineering departments (aerospace, civil, coastal and ocean- graphic, environmental and mechanical) have marine programs with B. S., M. S. and Ph. D. degrees</p>	<p>Director, Center for Aquatic Studies, University of Florida, Gainesville, FL 32601 Operates two laboratories and has cooperative arrangement with Marineland, Inc.</p>
<p>Fordham University Bronx, New York</p>	<p>M. S. and Ph. D. in biological sciences</p>	<p>Dean, Graduate School of Arts and Sciences, Fordham University, Bronx, NY 10458</p>
<p>Florida Presbyterian College St. Petersburg, Florida</p>	<p>Courses in marine sciences</p>	
<p>Fullerton Junior College Fullerton, California</p>	<p>A. A. in oceanographic technology</p>	<p>Oceanographic Technology Program Fullerton Junior College, 321 East Chapman Avenue, Fullerton, CA 92634</p>

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INSTITUTION

PROGRAMS OFFERED

OFFICE TO CONTACT: SPECIAL FACILITIES

Galveston Community College  
Galveston, Texas

A. A. in oceanographic technology

George Washington University  
Washington, D. C.

B. S. in oceanography

College of General Studies, George Washington  
University, 706 20th St., N. W.  
Washington, D. C. 20006

University of Georgia  
Athens, Georgia

M. S. and Ph. D. in botany, geology,  
microbiology, zoology and ecology,  
with marine science emphasis

Dean of the Graduate School, University of  
Georgia, Athens GA 30601  
Operates a marine institute at Sapelo Island and  
marine resources center at Skidaway Island.

University of Guam  
Agana, Guam

M. S. in biology

Chairman, Department of Biology, University of  
Guam, Agana GU 96910  
Operates a marine laboratory

Gulf Coast Junior College  
Panama City, Florida

A. A. S. with physical or biological  
option; A. A. in pre-oceanography

Division of Mathematics-Science, Gulf Coast  
Junior College, Panama City, FL 32401

Gulf Coast Technical  
Institute  
Gulfport, Mississippi

B. E. in marine technology ( with  
Mississippi State University)

Harvard University  
Cambridge, Massachusetts

M. A. and Ph. D. in biology; Ph. D. in  
physics, applied physics or mathematics

Division of Engineering and Applied Physics,  
Harvard University, Cambridge, MA 02138

University of Hawaii  
Honolulu, Hawaii

B. A., M. S., and Ph. D. in botany; M. S.  
in geodesy; B. A., B. S., M. S., and Ph. D.  
in geology; M. S., and Ph. D. in hydrology;  
B. S., M. S., and Ph. D. in meteorology;  
M. S., and Ph. D. in microbiology; M. S.,  
and Ph. D. in ocean engineering; M. S.,  
and Ph. D. in oceanography; M. S., Ph. D.  
in solid earth geophysics; B. A., M. S.,  
and Ph. D. in zoology.

Dean, Marine Programs, University of Hawaii,  
Honolulu, HA 96822  
Operates two marine laboratories

Highline Community College Midway, Washington	Certificate in undersea technology	Diving Instructor, Highline Community College, Midway, WA 98031
Hope College Holland, Michigan	Courses in oceanography and marine geology	
University of Houston Houston, Texas	M. S. and Ph. D. in biology; M. S. in geology; J. D. with emphasis on the marine field; M. S. and Ph. D. in chemical, civil electrical and mechanical engineering with ocean engineering options.	Dean, Graduate School, University of Houston, Houston, TX 77004 Operates field station at Galveston Bay
University of Illinois Urbana, Illinois	M. S. and Ph. D. in geology	
Indiana University Bloomington, Indiana	B. A., B. S., M. A. and Ph. D. in geology and zoology	Department of Geology, Indiana University, 1005 East 10th Street, Bloomington, IN 47401
Johns Hopkins University Baltimore, Maryland	M. A. and Ph. D. in oceanography	Chairman, Department of Earth and Planetary Sciences, Johns Hopkins University, Charles and 34th Streets, Baltimore, MD 21218 Operates Chesapeake Bay Institute
Lamar University Beaumont, Texas	B. S. in oceanographic technology	Head, Department of Geology, Box 10031 LU Station, Beaumont, TX 77710
Lehigh University Bethlehem, Pennsylvania	M. S. and Ph. D. in biology, chemistry, chemical engineering, civil engineering, geology, mechanical engineering and physics	Director, Center for Marine and Environmental Studies, Lehigh University, Bethlehem, PA 18015
Louisiana University Baton Rouge, Louisiana	M. S. and Ph. D. in marine sciences; M. S. with fisheries major; L.L.M. (master of laws) in marine resources law and policy	Chairman, Department of Marine Sciences, Louisiana State University, Baton Rouge, LA 70803 Operates Center for Wetland Resources & Coastal Studies Institute



INSTITUTION

University of Maine  
Orono, Maine

Maine Maritime Academy  
Castine, Maine

Southern Maine Vocational  
Technical Institute  
South Portland, Maine

College of Marine  
Kentfield, California

Maritime College of the  
State University of New York  
New York, New York

University of Maryland  
College Park, Maryland

Massachusetts Institute of  
Technology  
Cambridge, Massachusetts

PROGRAMS OFFERED

Ph. D. and M. S. in oceanography

B. A. in nautical science

A. A. in applied marine biology, oceanography or industrial marine science

A. S. in marine technology

B. S. in meteorology and oceanography;  
B. S. in marine nuclear science; B. E.  
in marine or electrical engineering and  
naval architecture

M.S. and Ph. D. in botany, chemistry,  
zoology, and mechanical engineering

Ph. D. or Sc. D. in oceanography offered  
jointly with Woods Hole Oceanographic Inst. ;  
M.S. in oceanography; M. S. and Sc. D. or  
Ph. D. in civil engineering; B. S. in naval  
architecture and marine engineering; M. S. in  
shipping and shipbuilding, marine engineering;  
naval architecture, naval engineering and  
ocean engineering; speciality masters and  
doctorate programs in engineering and naval  
architecture.

OFFICE TO CONTACT: SPECIAL FACILITIES

Dean of the Graduate School, University of Maine,  
Orono, ME 04473  
Operates marine research station

Marine Science Department, Southern Maine  
Vocational Technical Institute South Portland,  
ME 04106

Director of Marine Technology, College of Marine,  
Kentfield, CA 94904

Chairman, Science Department State University of  
New York, Maritime College, Fort Schuyler, NY  
10485

Heads, Departments of Botany, Chemistry,  
Zoology, and Mechanical Engineering, University  
of Maryland, College Park, MD 20742

Joint Program in Oceanography Massachusetts  
Institute of Technology, Room 54-912 or Ocean  
Engineering Information, 77 Massachusetts Ave.  
Cambridge, MA 02139

<p>University of Massachusetts Amherst, Massachusetts</p>	<p>M. S. in marine sciences; Ph. D. in botany, geology, microbiology and zoology; M. S. and Ph. D. in ocean engineering; Ph. D. in fisheries, biology and food science and technology</p>	<p>Chairman, Marine Sciences Program or Department of Civil Engineering, University of Mass., Amherst, MA 01002 Operates Gloucester Marine Station</p>
<p>University of Miami Rosenstiel School of Marine and Atmospheric Science Coral Gables and Miami, Florida</p>	<p>M. S. and Ph. D. in marine biological science, marine geology and geophysics, physical oceanography, chemical oceanography and atmospheric sciences; M. S. in ocean engineering; Ph. D. in civil and mechanical engineering with ocean engineering specialization; undergraduate ocean engineering as an option in civil, electrical, industrial and mechanical engineering programs; M. S. and Ph. D. in fishery science; LIM in ocean law; J. S. with ocean law specialization; no marine sciences undergraduate degrees.</p>	<p>Dean for Graduate Studies, School of Marine and Atmospheric Sciences, University of Miami, 10 Rickenbacker Causeway, Miami, FL 33149 Ocean Engineering Department, University of Miami, Coral Gables, FL 33124 Operates several research facilities in the greater Miami area</p>
<p>Miami-Dade Junior College Miami, Florida</p>	<p>A. S. in marine mechanical electronics and survey technologies</p>	<p>Chairman, Marine Technology, Miami-Dade Junior College 1090 N. W., North River Drive, Miami, FL 33136</p>
<p>Michigan State University East Lansing, Michigan</p>	<p>Ph. D. in geology</p>	<p>206 Natural Science Building, Michigan State University, East Lansing, MI 48823</p>
<p>University of Michigan Ann Arbor, Michigan</p>	<p>B. S. in meteorology &amp; oceanography; M. S. and Ph. D. in oceanography</p>	<p>Department of Meteorology and Oceanography, 4072 East Engineering Building, University of Michigan, Ann Arbor, MI 48104</p>
<p>Naval Postgraduate School Monterey, California</p>	<p>M. S. in oceanography and engineering acoustics (open to active duty military officers) and Ph. D. in oceanography (open to active duty military officers)</p>	<p>Chairman, Department of Oceanography, Naval Postgraduate School, Code 58, Monterey, CA 93940</p>

<u>INSTITUTION</u>	<u>PROGRAMS OFFERED</u>	<u>OFFICE TO CONTACT: SPECIAL FACILITIES</u>
Mississippi State University State College, Mississippi	Bachelor of engineering technology; major in marine engineering technology	Director, Institute of Engineering Technology, Drawer GL, State College, MS 39762
University of New Hampshire Durham, New Hampshire	B. S., M. S. and Ph. D. in biochemistry; B. S., M. S. and Ph. D. in botany; B. A. and M. S. in geology; B. A., M. S. and Ph. D. in microbiology; B. A., M. S. and Ph. D. in zoology, all with marine emphasis; B. S. and M. S. in chemical, civil, electrical and mechanical engineering; Ph. D. in engineering with varied options.	Office of Marine Science and Technology, Kings- bury Hall, University of New Hampshire, Durham, NH 03824 Operates estuarine laboratory
City University of New York New York, New York	B. S. in oceanography; M. A. and Ph. D. in biology, chemistry, geology and physics	Executive Office for Oceanography, The City College, Convent Ave., and 138th St., New York, NY 10031
State University of New York at Stony Brook Stony Brook, New York	M. S. in marine environmental studies; M. A. and Ph. D. in marine biology	Graduate Director, Marine Environmental Studies; or Graduate Director, Marine Biology, State University of New York at Stony Brook, Stony Brook, New York 11790 Operates three coastal laboratories
New York University New York, New York	B. S. and M. S. in meteorology or oceanography; Ph. D. with major in meteorology or oceanography	Chairman, Department of Meteorology and Oceanography, School of Engineering and Science, New York University, University Heights, Bronx, NY 10453
North Carolina State University Raleigh, North Carolina	M. S. and Ph. D. in marine sciences with major areas of interest in biological, physical and chemical oceanography, sea food processing and coastal engineering.	Dr. Jay Langfelder, Director, Center for Marine and Coastal Studies, 1204 Burlington Labs, North Carolina State University, Raleigh, North Carolina 27607

<p>✓</p> <p>University of North Carolina</p>	<p>M. S. and Ph. D. in marine sciences (in cooperation with N. C. State)</p>	<p>Curriculum in Marine Sciences, 17-7 Venable Hall, University of North Carolina, Chapel Hill, NC 27514 Operates one coastal laboratories</p>
<p>Northeastern Illinois State College Chicago, Illinois</p>	<p>B. A. or M. A. in earth sciences or geography with concentration in oceanography</p>	<p>Director, Oceanography Programs, Room C630, Northeastern Illinois State College, 5500 North St. Louis Avenue, Chicago, IL 60625</p>
<p>Northeastern University Boston, Massachusetts</p>	<p>M. A. and Ph. D. in biology and chemis- try; B. S. and M. S. in civil and mechan- ical engineering</p>	<p>Marine Science Institute, Northeastern University Boston, MA 02115 Operates Marine Science Institute at Nahnat</p>
<p>Nova University Fort Lauderdale, Florida</p>	<p>Ph. D. in physical or chemical oceanog- raphy, marine biology and physics</p>	<p>Oceanographic Laboratory, 1801 S. E., 15th St., Fort Lauderdale, FL 33316</p>
<p>48</p> <p>Old Dominion University Norfolk, Virginia</p>	<p>M. S. with oceanography concentration</p>	<p>Dean of Graduate Studies, Old Dominion University, Norfolk, VA 23508 Operates Institute of Oceanography</p>
<p>✓</p> <p>Oregon State University Corvallis, Oregon</p>	<p>M. S., M. A. and Ph. D. in oceanography; M. S., M. A. and Ph. D. in geophysics; M. S., Master of Ocean Engineering and Ph. D. in engineering; M. S. and Ph. D. in fisheries science; B. S., M. S. and Ph. D. in food science</p>	<p>School of Oceanography or Dean of Engineering or Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97351 Operates Marine Science Center at Newport</p>
<p>✓</p> <p>University of Oregon Eugene, Oregon</p>	<p>B. A., M. A. and Ph. D. in biology; J. D. in ocean law</p>	<p>Director, Oregon Institute of Marine Biology, Charleston, OR 97420</p>
<p>Orange Coast College Costa Mesa, California</p>	<p>A. A. in marine technology</p>	<p>Department of Marine Sciences, Orange Coast College, 2701 Fairview Road, Costa Mesa, CA 92626</p>

<u>INSTITUTION</u>	<u>PROGRAMS OFFERED</u>	<u>OFFICE TO CONTACT; SPECIAL FACILITIES</u>
✓ University of the Pacific Stockton, California	B.A. in biology; M.S. in biological sciences	Chairman, Department of Biological Sciences, University of the Pacific, Stockton, CA 95204 Operates Pacific Marine Station at Dillon Beach
✓ Palomar Junior College San Marcos, California	Undergraduate courses in oceanography	President, Palomar Junior College, San Marcos CA 92609
Peninsula College Port Angeles, Washington	A. A. in fisheries	Registrar, Peninsula College, Port Angeles, WA 98362
Pennsylvania State University University Park, Pennsylvania	B. A. and advanced degrees in geology, geophysics, mineralogy and geochemistry	Dean for Resident Instruction, 101 Mineral Sciences Building, Pennsylvania State University, University Park, PA 16802
⊗ University of Pennsylvania Philadelphia, Pennsylvania	B. A. in geology	Department of Geology, University of Pennsylvania, Philadelphia, PA 19104
Princeton University Princeton, New Jersey	Ph. D. in marine geology and physical oceanography	Dean of the Graduate School Princeton University, Princeton, NJ 08540
✓ University of Puerto Rico Mayaguez Puerto Rico	M.S. in marine sciences	Department of Marine Sciences, University of Puerto Rico, Mayaguez, PR 00708
✓ University of Rhode Island Kingston, Rhode Island	M.S. and Ph. D. in oceanography; Master in Marine Affairs; M.S. and Ph.D. in ocean engineering; A.S. in commercial fisheries	Provost for Marine Affairs or Chairman, Ocean Engineering Department, University of Rhode Island, Kingston, RI 02881 Operates two laboratories
Rutgers State University of New Jersey New Brunswick, New Jersey	Ph. D. in botany, ecology, environmental science, geology, microbiology, zoology and geophysical fluid dynamics; M.S. in ocean engineering, undergraduate engineering programs with marine emphasis	Department of Zoology or Department of Electrical Engineering, Rutgers University, New Brunswick, NJ 08903 Operates three shellfish labs

Rensselaer Polytechnical Institute Troy, New York	B. S., M. S. and Ph. D. in geology with marine science emphasis	Dean of Admissions, Rensselaer Polytechnical Institute, Troy NY 12181
Salem State College Salem, Massachusetts	Undergraduate biology and geology programs with marine courses	Department of Biology, Salem State College, Salem, MA 01970
San Diego Community Colleges (City, Mesa and Evening) San Diego, California	A. S. in compatible fields using marine technology elective courses or certificate in marine technology	Director of Vocational Education, San Diego Community Colleges, 835 12th Ave., San Diego, CA 92101
Santa Barbara City College Santa Barbara, California	A. S. for marine diving technician	Dean, Vocational Technical Education, Santa Barbara City College, 721 Cliff Dr., Santa Barbara, CA 93105
Scripps Institution of Oceanography University of California, San Diego La Jolla, California	M. S. and Ph. D. in oceanography, marine biology or earth sciences	Graduate Department, Scripps Institution of Oceanography, La Jolla, CA 92037 Has extensive research facilities
Seattle Central Community College Seattle, Washington	Associate, marine engineering technology	Registrar, Seattle Central Community College, 1718 Broadway, Seattle, WA 98122
Seattle Pacific College Seattle, Washington	B. S. in biology with marine option	Director, Marine Biology Program, Seattle Pacific College, Seattle, WA 98119
Shoreline Community College Seattle, Washington	A. A., A. S. as marine biology technician, oceanographic technician, or environmental technician.	Department of Life Sciences, Shoreline Community College, Seattle, WA 98133
University of South Florida St. Petersburg, Florida	M. S. in marine science	Director, Marine Science Institute, University of South Florida, 830 First St. S., St. Petersburg, FL 33701

<u>INSTITUTION</u>	<u>PROGRAMS OFFERED</u>	<u>OFFICE TO CONTACT;SPECIAL FACILITIES</u>
Southampton College Long Island University Southampton, New York	B. S. in marine sciences with concentration in marine biology, marine chemistry and marine geology	Director, Division of Natural Sciences, Southampton College, Southampton, NY 11968 Operates on-campus Marine Operations and Research Laboratory and Station
Southeastern Massachusetts University North Dartmouth, Massachusetts	B. S. in biology with marine option; M. S. in marine biology; B. S. in electrical or civil engineering all with ocean options	Coordinator of Graduate Studies, Department of Biology or Dean, College of Engineering, Southeastern Massachusetts University, North Dartmouth, MA 02747
University of Southern California Los Angeles, California	Ph. D. in geology with marine specialization; Ph. D. in oceanography; M. S. and M. A. in geological sciences with marine specialization; B. S., M. S. and Ph. D. in biological sciences with specialization in marine biology or biological oceanography; M. S. in ocean engineering.	Director, Allan Hancock Foundation, University of Southern California, University Park, CA 90007 Operates Marine Sciences Center on Santa Catalina Island
University of Southern Mississippi Hattiesburg, Mississippi	M. A., M. S. in geology; M. A., M. S. in biology; Ph. D. in marine biology	Dean of Graduate School, University of Southern Mississippi, Hattiesburg Ms 39401
St. John's University Jamaica, New York	B. S. in biology; M. S. and Ph. D. in biology with concentration in marine biology	Department of Biology, St. John's University, Grand Central and Utopia Pkwy's, Jamaica, NY 11432
Stevens Institute of Technology Hoboken, New Jersey	Ph. D. and M. E. in ocean engineering	Department of Ocean Engineering, Stevens Institute of Technology, Castle Point Station, Hoboken, NJ 07030
Hopkins Marine Station Stanford University Pacific Grove, California	Ph. D. in biology	Director, Hopkins Marine Station, Pacific Grove, CA 93950

Suffolk County Community College Selden, New York	Associate in Applied Science	Dept. of Marine Science and Tech., Suffolk Community College, Selden, Long Island, NY 11784
Suffolk University Boston, Massachusetts	B. A., B. S. and M. A. in education with marine science courses	Director of Admissions, Suffolk University, 41 Temple St., Boston MA 02114 Operates marine field station at Edmunds, Maine
Texas A&M University College Station, Texas	M. S. and Ph. D. in oceanography; M. S. and Ph. D. in zoology, microbiology, botany or biology; M. S. in marine resources management; M. E., M. S. and Ph. D. in civil engineering with coastal, ocean engineering or environmental engineering majors	Head, Department of Oceanography or Head, Civil Engineering Department, Texas A&M University, College Station TX 77843 Operates Marine Laboratory at Galveston and Coastal Engineering Laboratory
Texas Christian University Fort Worth, Texas	M. S. in biology, environmental science or geology; M. S. in environmental science	Director, Environmental Sciences Program, Dept. of Biology, Texas Christian University, Fort Worth, TX 76129
University of Texas Arlington, Texas	M. A. in biology, chemistry and physics, M. S. in geology	Dean of the School of Science, University of Texas Arlington, TX 76010
Tufts College Medford, Massachusetts	Courses in arctic meteorology and oceanography	Director of Admissions, Tufts University, Medford MA 02155
U. S. Coast Guard Academy New London, Connecticut	B. S. with ocean science, ocean engineering, or marine engineering option	Dean of Academics, Coast Guard Academy, New London, CT 06320
U. S. Department of Agriculture Graduate School Washington, D. C.	Certificate of Accomplishment in oceanography	Registrar, The Graduate School, Department of Agriculture, Washington, DC 20250
U. S. Naval Academy Annapolis, Maryland	B. S. with oceanography major; B. S. in marine engineering, naval architecture or ocean engineering	Academic Dean, U. S. Naval Academy, Annapolis, Maryland, 21402

<u>INSTITUTION</u>	<u>PROGRAMS OFFERED</u>	<u>OFFICE TO CONTACT: SPECIAL FACILITIES</u>
Virginia Institute of Marine Science Gloucester Point, Virginia	M. A. and Ph. D. in marine science with College of William and Mary; M. A. and Ph. D. in marine science with Univ. of Virginia	Director, Virginia Institute of Marine Science, Gloucester, Point, VA 23062
Walla Walla College College Place, Washington	M. A. in biology, with marine emphasis	Chairman, Department of Biology, Walla Walla College, College Place, WA 99324
Washington and Lee University Lexington, Virginia	B. S. in geology with marine emphasis	Chairman, Geology Department, Washington and Lee University, Lexington, VA 24450
University of Washington Seattle, Washington	B. A., B. S., M. S., and Ph. D., in oceanography; B. S., M. S., and Ph. D. in fisheries, and in food science; ocean engineering option for M. S. and Ph. D. in traditional engineering departments	Chairman, Department of Oceanography; Dean, College of Fisheries, or Director, Division of Marine Resources, University of Washington, Seattle, WA 98195. Operates Marine Biological Station at San Juan Island
Washington Technical Institute Washington, D. C.	A. S. in marine technology	Washington Technical Institute, 4100 Connecticut Ave. N. W., Washington, D. C. 20008
Webb Institute of Naval Architecture Glen Cove, New York	B. S. in naval architecture and marine engineering	President, Webb Institute of Naval Architecture, Glen Cove, NY 11542
University of West Florida Pensacola, Florida	M. S. in biology, with estuarine studies or marine sciences option	Department of Biology, University of West Florida, Pensacola, FL 32504
Western Washington State College Bellingham, Washington	B. A. and M. S. in biology; B. A., B. S. and M. S. in geology; B. Sc. in marine bioresources and/or water quality	Chairman, Department of Biology; Western Washington State College, Bellingham, WA 98225

University of Wisconsin  
Madison Wisconsin

Ph. D. in oceanography and limnology;  
M.S. in ocean engineering; Ph. D. with  
ocean engineering option

Chairman, Oceanography and Limnology Com-  
mittee, Univ. of Wisconsin, 1225 W. Dayton St.,  
Madison, WI 53706 Operates Marine Research  
Lab. Ocean engineering facility and has access to  
the Center for Great Lakes Studies, University of  
Wisconsin, Milwaukee

Woods Hole Oceanographic  
Institution  
Woods Hole, Massachusetts

Ph. D. and Sc. D. in oceanography - with  
specialization in biological oceanography,  
chemical oceanography, marine geology and  
geophysics, or physical oceanography offered  
jointly with MIT and independently. Ph. D.,  
Sc. D. and Ocean Engineer degree in ocean  
engineering offered jointly with MIT. Co-  
operative arrangements for cross-registration  
in effect with Harvard, Yale, and Brown.

Dean of Graduate Studies, Woods Hole Oceanographic  
Institution, Woods Hole, MA 02543  
Has extensive facilities

# The Oceans and You

## MARINE TECHNICIANS

A number of institutions offer an alternate method of entering the marine field from the traditional route cited in this booklet of acquiring advanced training to become a scientist or engineer. This is the two-year marine technician program where students earn associate degrees.

Many of the schools offering two-year marine or oceanographic technician courses are listed in the curricula portion of this publication. They can be spotted as those institutions offering degrees such as the B. A. and B. S. in various categories. Note that this is a new type of program and is undergoing rapid change; the enclosed listing of schools offering these programs is likely to be out of date and prospective students should check with counselors and other sources about current offerings.

Because the field is new, there are some different approaches as to what is meant by "marine technician." What follows is drawn from several sources: two generalized descriptions of the field together with discussion about technician work in one particular aspect of ocean endeavor, and material drawn from two marine technician programs now in operation.

While this discussion emphasizes educational training beyond high school, it should be pointed out that jobs in the marine field, broadly defined, are open to people without such training. For instance, many of the jobs at a sailing marina would not require specialty training. While such jobs are far removed from scientific ocean study, they are well-suited for many who wish to be near the ocean or major lakes but who are not interested in formal education beyond high school.

According to one study, only six percent of "marine technicians" actually go to sea in the following areas of endeavor: offshore mineral exploration and production; physical oceanography and hardware technology; biological, biochemical and pharmacological research; aquaculture; and fisheries. Another version, drawn from a conference of marine technician educators, identified eight major areas of prospective employment: offshore petroleum production fishing and seafood processing, aquaculture; mineral and chemical resource extraction, recreation sea craft maintenance, sea craft operation and marine environmental management.

### Marine Biological Technician

One type of marine technician is the person trained in biological science. The following is drawn from an account of what jobs such a person might perform. It is meant to be suggestive of what the marine technician field is like.

Such a person might be employed as an assistant studying effects of underwater fouling of offshore drilling rigs. Or, a marine biological technician might help consult a sonar equipment manufacturer who needs to know about sound emissions from marine creatures and their density in the sea. Or, he or she might serve as a specialist on a fish processing vessel.

Technicians of this type would perform tasks like gather, sort, classify, analyze or breed all types of marine life. Typical job classifications for

such a worker might include: aquarist, aquaculture technician, marine quality control technician, estuarine research assistant, sea duty technician, marine pollution research assistant, marine pharmacognosy technician or fish processing technician.

#### Sample Programs

Two sample marine technician training programs are located at the Southern Maine Vocational Technical Institute in South Portland, Maine, and at Cape Fear Technical Institute, Wilmington, North Carolina. Excerpts from descriptive material about (and furnished by) each institution follow:

"The marine technicians graduating from Southern Maine Vocational Technical Institute complete a two-year post/secondary level curriculum related in the marine field. They are variously called physical science technicians, marine resource technicians, deck support technicians, marine environmental technicians, marine laboratory assistants, marine science aides etc. Most definitions refer to duties like collecting data, maintaining field stations, sorting, describing and analyzing samples, surveying and inspecting certain marine environments, operating certain technical equipment, conducting tests for sea water characteristics.

"The marine technician's major role is to carry out repetitive procedures, gradually becoming highly skilled in these procedures with time . . .

"The Marine Science Program at S. M. V. T. I. is designed to produce technicians who are conversant with the above-mentioned skills. A percentage of the school year is spent at sea on the training vessel. Students are required to participate in sea trips each semester. Such participation includes deck, engine-room, and oceanographic station watch. When the vessel is in port (other than her home port), the students are required to stand in-port security watches. Discipline aboard the vessel meets the rigid demands of maritime requirements.

"Second-year students specialize in either the deck and oceanography or the engineering and oceanography phase of the course. This two-year program is available as an associate degree or as a diploma program. The enrollment of students in a degree or non-degree industrial program depends on either academic background and ability to carry related subjects. From the industrial program, the students may receive a degree by acquiring additional courses in the humanities and the natural sciences. A technician in applied marine biology and oceanography is a semi-professional with two years of post high school training in physical, chemical, marine biological or general oceanographic studies. Students in this degree program take all college-level courses as well as mathematics and humanities required for an associate degree. These students may also pursue their education in this field beyond the associate degree level. . .

"From the records of our graduates for the past six years (as of 1971), it shows that industry has hired 63 percent of our total output, and 18 percent of the graduates pursued their higher education at a four-year institution, 14 percent were called for the armed service and five percent of the students did not reply to our survey. (The salary range for 1970 was between \$5,000 and \$8,000 with a mean of about \$6,000.) The following list show a few of the organizations where our graduates have been placed: Alpine Geophysical Corp., National Marine Fisheries Service of the National Oceanic and Atmospheric Administration, Casco Bay Lines, Florida Institute of Technology, Narragansett Marine Laboratory, Research Institute of the Gulf of Maine, Sandy Hook Marine Biological Laboratory, Sea & Shore Fisheries of Maine, Smithsonian

Oceanographic Sorting Center, U. S. Naval Oceanographic Office, University of Rhode Island, Vast Inc., Deep Sea Ventures, Inc. and University of Texas, Houston.

"The following is a list of positions that our graduates have filled from the training background at S. M. V. T. I.: oceanographic laboratory technician, fisheries technician, hydrographic survey technician; limnological laboratory technician, marine engineering technician, deck support technician, oceanographic instrumentation technician, marine product technician, underwater technician and scientific support party chief."

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"(The curriculum in marine technology at Cape Fear Technical Institute is) a two-year (eight quarter) program designed to prepare students for careers as marine technicians. A 'hands-on' approach is utilized in presenting the function and use of shipboard and laboratory equipment and techniques. Included, along with the marine science aspects of the program, are the basics in mathematics, physics, chemistry, biology, geology, navigation, diesel engineering, fishing operations and seamanship. At sea shipboard experience is the focal point of the program.

"The following is partial list of employers who have hired Cape Fear Technical Institute's marine technology graduates: U. S. Naval Oceanographic Office, U. S. Army Corps of Engineers, National Oceanic and Atmospheric Administration, Virginia Institute of Marine Science, Deep Sea Ventures, Inc., Marine Acoustical Services and New Hanover (N. C.) County High Schools.

"(The curriculum in marine laboratory technology) is a two-year (six quarters) program designed to prepare students for careers as shore-based laboratory technicians. Emphasis is placed on the techniques and equipment used in the analysis of chemical and biological samples. The following is a partial list of employers who have hired Cape Fear Technical Institute's marine laboratory technology graduates: State of North Carolina Division of Commercial and Sport Fisheries, Georgia Power and Light Co. and Virginia Institute of Marine Science."

Other places of employment of Cape Fear Technical Institute graduates in 1971, beyond those cited in the two listings above, include Diamond Shamrock Chemical Co., Professional Diving Academy, University of Georgia, Bradley Creek Marina, Barnacle Bill's Pier, Carl Winner Charter Boats, Interior Department Saline Water Research Station, Brown and Root Corp. and Wrightsville Beach Marine Bio-Medical Lab of the University of North Carolina at Wilmington.

There exists a question as to the extent of actual demand for trained marine technicians in the near future. Some state that there is a definite need for all those presently undergoing such training and more besides. Others question this and point to difficulties experienced by some graduates of some of the schools in finding employment. The best approach would seem to be one of wariness of claims of sure employment. Prospective students should attempt to talk with recent graduates and persons enrolled at schools of interest to get up-to-date insight into the employment picture.

Here is one description of the situation, taken from the report, "Marine Technology Programs: Where We Are and Where We're Going" published in 1971 by the American Association of Junior Colleges reporting on a conference:

"The conclusion of the conferees was, however, that even though there was some difficulty placing graduates in jobs of their first choice during the

recent recession period, everyone who wanted a job relating to his field got one. This was true in spite of the large number of individuals with higher degrees who in some cases were competing for the same job. However, one saving factor was that only small numbers were looking.

"The conferees generally agreed that the hundreds of jobs in one location, predicted just a few years ago, were not available and probably would not be in the near future. Except for the graduates of programs focusing almost exclusively on diving, most of the jobs were land-based. Less than 20 percent of the others were employed as ocean-type technicians. The technicians were, for the most part, involved in examining, gathering, monitoring and surveying data and information in field and plant sites."

One of the participants in the conference, and a director of one of the marine technician programs, put the situation as he sees it in blunter language in a private communication with the Marine Technology Society.

"I personally feel that for the past five years we have been saying to high school graduates what oceanography is. Sometimes the subject has been glamorized to attract youngsters to pursue their education in this field. The time has come where we should tell them what oceanography is not, such as the job opportunity (situation) at present does not look so bright and that future need of technicians will depend on Federal government interest in the ocean. At present there are more technicians trained in this country than there are jobs available.

"Also, when a student is working as a technician, he will be spending a lot of time doing routine work, which would sometimes be very boring. He is liable to get seasick, cold and miserable aboard an oceanography vessel. There will be no TV cameras or magazine reporters interviewing him while he is in the middle of the ocean. These are a few of the facts that a student should remember before entering this field".

While others equally involved in the marine technician training effort evidence a more optimistic view, what seems clear that all statements about the certain growth of the technician job market or inevitability of rapid expansion of ocean activity and all similar statements should be looked at with care.

## READING LIST

The following selection of books has been grouped into three categories, indicating the approximate degree of reading difficulty.

Elementary books range from those which may be read by beginning students to those of interest to a junior high student.

Secondary level books are appropriate for high school and lower level college students and include many books of general interest for those of all ages.

The adult category, which includes many technical books, was developed for the serious student and more sophisticated reader.

The list is by no means comprehensive but represents a selection of the broad range of publications presently available in marine sciences literature.

- Denotes books on which MTS members may receive a 10 percent discount.

### ELEMENTARY

- Adler, Irving and Ruth. Oceans. New York, NY, The John Day Co., 1962. 48 p. \$2.68.
- Andrews, Roy Chapman. All About Whales. New York, NY, Random House, 1954. \$2.95.
- Arnold, Oren. Marvels of the Sea and Shore. New York, NY, Abelard-Schuman, 1963. 158 p. \$3.75.
- Arnov, Boris, Jr. Oceans of the World. Indianapolis, In, The Bobbs-Merrill Co., Inc., 1962. 190 p. \$3.50.
- . Wonders of the Deep Sea. Eau Claire, Wi, E. M. Hale and Co., 1959. 96 p.
- Barlowe, Sy. Oceans. New York, NY, Follett Publishing Co., 1969.
- Behrendt, Ernst. Oceans. Garden City, NY, Doubleday and Co., Inc., 1963. 64 p.
- Bergaust, Erick and W. O. Foss. Skin Divers in Action. New York, NY, G. P. Putnam's Sons, 1965. 95 p.
- Berrill, Jacquelyn. Wonders of the Seashore. New York, NY, Dodd, Mead and Co., 1951. 69 p.
- Berrill, Norman J. The Life of the Ocean. New York, NY, McGraw-Hill Book Co., 1966. 232 p. \$4.95.
- Berrill, Norman J. and Jacquelyn. 1001 Questions Answered About the Seashore. New York, NY, Dodd, Mead and Co., 1957. 305 p. \$1.75.
- Blassingame, Wyatt. The First Book of the Seashore. New York, NY, Franklin Watts, Inc., 1964. 60 p. \$2.65.
- Brindze, Ruth. The Gulf Stream. New York, NY, The Vanguard Press, 1945. 62 p. \$3.95.
- . All About Undersea Exploration. New York, NY, Random House, 1960. 145 p. \$2.95.
- Buehr, W. World Beneath the Waves. New York, NY, W.W. Norton and Co., Inc., 1964. 112 p. \$3.25.

- Burton, Maurice. *In Their Element: The Story of Water Mammals*. New York, NY, Abelard-Schuman, 1960. 155 p.
- . *The Sea's Inhabitants*. London, Weidenfeld, 1968. 48 p.
- Cadbury, B. Bartram. *The Community of Living Things in Fresh and Salt Water*. Mankato, Mn, Creative Educational Society, Inc., 1960. \$4.95.
- Carr, Marion Bergner. *The Golden Picture Book of Sea and Shore*. New York, NY, Golden Press, 1959. 57 p.
- Carter, Katharine. *True Book of Oceans*. Chicago, Il, Children's Press, Inc., 1958. \$2.50.
- Cheney, Cora and Ben Partridge. *Underseas! The Challenge of the Deep Frontiers*. New York, NY, Coward-McCann, 1961. 121 p. \$2.95.
- Chester, Michael and Thomas. *Submersibles and Undersea Labs of the World*. New York, NY, Norton and Co., Inc., 1970. 192 p. \$5.95.
- Clarke, Arthur C. *Boy Beneath the Sea*. New York, NY, Harper and Row, 1958. 64 p.
- Clemons, Elizabeth. *Tide Pools and Beaches*. New York, NY, Alfred A. Knopf, 1964. 78 p. \$2.95.
- . *Waves, Tides, and Currents*. New York, NY, Alfred A. Knopf, 1967. 112 p. \$3.75.
- Coe, Geoffrey. *The How and Why Wonder Book of Fish*. New York, NY, Grosset and Dunlap, 1963. 48 p. \$1.25.
- Coombs, Charles. *Deep Sea World: The Story of Oceanography*. New York, NY, William Morrow and Co., 1966. 256 p. \$4.95.
- Cooper, Elizabeth K. *Science on the Shores and Banks*. New York, NY, Harcourt, Brace and Co., 1960. 187 p. \$3.50.
- Darling, Lois and Louis. *Coral Reefs*. Cleveland, Oh, The World Publishing Co., 1963. 86 p. \$2.95.
- Daugherty, Charles Michael. *Searchers of the Sea*. New York, NY, The Viking Press, 1961. 160 p. \$3.00.
- Dubach, Harold W. and Robert W. Taber. *Questions About the Oceans*. Washington, DC, Naval Oceanographic Office, 1968. 121 p. \$.55.
- Dugan, James. *Undersea Explorer: The Story of Captain Cousteau*. New York, NY, Harper and Row, 1957. \$3.95.
- Ellam, Patrick. *Underwater and Sea Adventure*. New York, NY, Grosset and Dunlap, 1961. 92 p. \$1.95.
- Engel, Leonard. *The Sea*. New York, NY, Time, Inc., 1961. 190 p. \$5.00.
- Epstein, Sam and Beryl. *First Book of the Ocean*. New York, NY, Franklin Watts, Inc., 1961. 72 p. \$2.65.
- Gaskell, T. F. *World Beneath the Oceans*. Garden City, NY, The Natural History Press, 1964. 154 p. \$4.95.
- Gendron, Val and David A. McGill. *Whales*. New York, NY, Follett Publishing Co., 1965. 30 p. \$1.00.
- Goudey, Alice E. *Here Come the Whales*. New York, NY, Charles Scribner's Sons, 1956.
- . *Here Come the Dolphins!* New York, NY, Charles Scribner's Sons, 1961.

- Greenhood, David. *Watch the Tides*. New York, NY, Holiday House, 1961.
- Hausman, Leon A. *Beginner's Guide to Seashore Life*. New York, NY, G. P. Putnam's Sons, 1949. \$2.75.
- Hollings, H. C. *Pagoo*. Boston, Ma, Houghton-Mifflin Co., 1957. 87 p. \$3.75.
- Holsaert, Eunice and F. *Ocean Wonders*. New York, NY, Holt, Rinehart and Winston, 1965. \$2.75.
- Huntington, Harriet E. *Let's Go To the Seashore*. Garden City, NY, Doubleday and Co., Inc., 1941. \$3.50.
- Hyde, Wayne. *What Does a Diver Do?* New York, NY, Dodd, Mead and Co., 1961. 62 p.
- Hylander, Clarence J. *Sea and Shore*. New York, NY, The Macmillan Co., 1950. 242 p. \$3.95.
- Jackson, Caary. *Seashores and Seashore Creatures*. New York, NY, G. P. Putnam's Sons, 1964. 96 p. \$2.95.
- Kinney, Jean and Cle. *What Does the Tide Do?* New York, NY, Young Scott Books, 1966. \$3.95.
- Knowlton, William. *Let's Explore Beneath the Sea*. New York, NY, Alfred A. Knopf, 1957. 139 p.
- Lambert, Elisabeth. *Living Sea*. New York, NY, Coward-McCann, 1963. 126 p. \$3.50.
- Lane, Ferdinand C. *All About the Sea*. New York, NY, Random House, 1953. 148 p. \$2.95.
- Low, Donald F. *The How and Why Wonder Book of Sea Shells*. New York, NY, Grosset and Dunlap, 1961. 48 p. \$1.25.
- Maidoff, Ilka. *Let's Explore the Shore*. New York, NY, Astor-Honor, 1962. 105 p.
- McCarthy, Agnes. *Creatures of the Deep*. Englewood Cliffs, NJ, Prentice-Hall, 1963. 79 p. \$3.50.
- McClung, Robert M. *Horseshoe Crab*. New York, NY, William Morrow and Co., 1967. 48 p. \$2.95.
- Morgan, Elizabeth. *In the Deep Blue Sea*. Englewood Cliffs, NJ, Prentice-Hall, 1962. 72 p. \$3.50.
- Parker, Bertha M. *Animals of the Seashore*. New York, NY, Harper and Row, 1957.
- Pennington, Howard. *The New Ocean Explorers*. Boston, Ma, Little, Brown & Co., 1972. 282 p. \$5.95.
- Pfadt, Robert E. *Animals Without Backbones*. New York, NY, Follett Publishing Co., 1967. 30 p. \$1.00.
- Phleger, Fred B. *The Whales Go By*. New York, NY, Random House, 1959. \$1.95.
- Phleger, Fred B. and Marjorie. *You Will Live Under the Sea*. New York, NY, Random House, 1966. \$1.95.
- Pincus, Howard J. *Secrets of the Sea*. Columbus, Oh, American Education Publications, 1960. 31 p. \$.15.
- Podendorf, Ila. *True Book of Animals of Sea and Shore*. Chicago, Il, Children's Press.
- Ray, Carleton. *Wonders of the Living Sea*. New York, NY, Home Library Press, 1963. 56 p. \$3.50.
- Reed, William Maxwell and Wilfrid S. Bronson. *The Sea For Sam*. New York, NY, Harcourt, Brace and World, Inc., 1960 (revised ed.). 243 p. \$4.95.
- Riedman, Sarah Regal. *Let's Take a Trip To a Fishery*. New York, NY, Abelard-Schuman, 1956. 127 p.

- Scharff, Robert. *The How and Why Wonder Book of Oceanography*. New York, NY, Grosset and Dunlap, 1964. 48 p. \$.50.
- Schick, E. *I'm Going To the Ocean*. New York, NY, The Macmillan Co., 1966. \$2.50.
- Selsam, Millicent E. *Underwater Zoos*. New York, NY, William Morrow and Co., 1961. 98 p. \$2.95.
- Sherman, Diane. *You and the Oceans*. Chicago, Il, Children's Press, 1965. 60 p. \$2.50.
- Solem, Alan. *Life Along the Seashore*. Chicago, Il, Encyclopedia Britannica Press, 1963.
- Spilhaus, Athelstan. *Turn To the Sea*. Racine, Wi, Whitman Publishing Co., 1962.
- . *The Ocean Laboratory*. Mankato, Mn, Creative Educational Society, 1967. 112 p.
- Stephens, William M. *Science Beneath the Sea*. New York, NY, G. P. Putnam's Sons, 1966. 224 p.
- Telfer, Dorothy. *Exploring the World of Oceanography*. Chicago, Il, Children's Press, 1968.
- Tinker, Gene and Barbaras. *Let's Learn to Snorkel*. New York, NY, Walker, 1968.
- Verite, Marcel. *Animals of the Sea*. Chicago, Il, Children's Press, 1968.
- Vevers, Gwynne. *Life in the Sea*. New York, NY, McGraw-Hill Book Co., 1963. 32 p. \$2.95.
- Vogel, Helen W. and Mary L. Caruso. *Ocean Harvest*. New York, NY, Alfred A. Knopf, 1961. 144 p.
- Wagner, Frederick. *Famous Underwater Adventurers*. New York, NY, Dodd, Mead and Co., 1962. 159 p.
- Wakeman, Norman Hammond. *Wonders of the World Between the Tides*. New York, NY, Dodd, Mead and Co., 1961. 63 p. \$3.00.
- Ware, Kay and L. Sutherland. *Let's Read About the Sea*. New York, NY, McGraw-Hill Book Co., 1960. \$.80.
- Waters, Barbara and John. *Salt-Water Aquariums*. New York, NY, Holiday House, 1967. 161 p. \$3.95.
- Wright, Helen and Samuel Rappert, eds. *Great Underseas Adventures*. New York, NY, Harper and Row, 1966. 381 p.
- Zim, Herbert S. *Waves*. New York, NY William Morrow and Co., 1967. 63 p. \$2.95.
- Zim, Herbert S. and Lester Ingle. *Seashores*. New York, NY, Golden Press, 1955. 160 p. \$1.25.
- Zim, Herbert and Hurst Shoemaker. *Fishes*. New York, NY, Golden Press, 1956. 160 p. \$1.25.

## SECONDARY

- Abbott, R. Tucker. *Introducing Sea Shells*. New York, NY, Van Nostrand, 1955. 64 p. \$3.95.
- \_\_\_\_\_. *Sea Shells of the World; A Guide to the Better Known Species*. New York, NY, Golden Press, 1962. 160 p. \$3.95.
- Alexander, W. B. *Birds of the Ocean*. New York, NY, G. P. Putnam's Sons, 1954.
- Alpers, Antony. *Dolphins: The Myth and the Mammal*. Boston, Ma, Houghton Mifflin, 1961. 268 p. \$5.00.
- Amos, William H. *The Life of the Seashore*. New York, NY, McGraw-Hill Book Co., 1966. 231 p. \$4.95.
- Balder, A. P. *The Complete Manual of Skin Diving*. New York, NY, MacMillan Co., 1968. 302 p.
- Bardach, J. E. *Harvest of the Sea*. New York, NY, Harper and Row, 1967. 301 p. \$6.95.
- Bascom, Willard. *A Hole in the Bottom of the Sea*. Garden City, NY, Doubleday and Co., Inc., 1961. 352 p. \$5.95.
- \_\_\_\_\_. *Great Sea Poetry*. Arlington, Va, Compass Publications, Inc., 1969. 119 p. \$4.95.
- Behrman, Daniel. *The New World of the Oceans*. Boston, Ma, Little, Brown & Co., 1969. 436 p. \$8.95.
- Blair, Clay. *Diving For Pleasure and Treasure*. Cleveland, Oh, The World Publishing Co., 1960. 352 p. \$7.50.
- Bohlke, James E. and Charles C. G. Chaplin. *Fishes of the Bahamas*. Wynnewood, Pa, Livingston Publishing Co., 1968. 771 p. \$29.50.
- Buchsbaum, Ralph. *Animals Without Backbones*. Chicago, Il, University of Chicago Press, 1955. 405 p. \$9.50.
- Burton, Maurice. *Under the Sea*. New York, NY, Franklin Watts, Inc., 1960. 256 p. \$4.95.
- Butterfield, Alfred and Jerry Greenberg. *The Coral Reef*. New York, NY, Odyssey Press, 1964. 45 p. \$.95.
- Carlisle, Norman. *Riches of the Sea*. New York, NY, Sterling Publishing Co., Inc., 1967. 136 p. \$4.95.
- Carrington, R. *A Biography of the Sea*. New York, NY, Basic Books, 1960. 285 p. \$6.00.
- Carson, Rachel L. *The Sea*. Omnibus edition of "The Sea Around Us," "Under the Sea," and "The Edge of the Sea." London, MacGibbon and Kee, 1964. 611 p.
- \_\_\_\_\_. *Silent Spring*. New York, NY, Fawcett Publications. \$.95.
- Ciampi, Elgin. *The Skin Diver; A Complete Guide to the Underwater World*. New York, NY, The Ronald Press Co., 1960. 315 p. \$6.00.
- Clark, Eugenie. *The Lady and the Sharks*. New York, NY, Harper & Row, 1969. 269 p. \$6.95.
- Clarke, Arthur C. *The Challenge of the Sea*. New York, NY, Holt, Rinehart and Winston, 1960. 187 p. \$3.95.
- Coker, R. E. *This Great and Wide Sea*. New York, NY, Harper & Row, 1962. 325 p. \$2.25.

- Conference For National Cooperation in Aquatics. *New Science of Skin and Scuba Diving*. New York, NY, Association Press, 1967 (4th edition). 224 p. \$2.95.
- Cousteau, Jacques-Yves and James Dugan. *The Living Sea*. New York, NY, Harper & Row, 1963. 325 p. \$6.95.
- \_\_\_\_\_. *World Without Sun*. New York, NY, Harper & Row, 1964. 205 p. \$10.00.
- Cousteau, Jacques-Yves and F. Dumas. *The Silent World*. New York, NY, Harper & Row, 1953. 266 p. \$6.50.
- Cowen, R. D. *Frontiers of the Sea*. Garden City, NY, Doubleday & Co., Inc., 1960. 307 p. \$5.95.
- Craig, John D. and Clint Degn. *Invitation to Skin and Scuba Diving*. New York, NY, Simon and Schuster, 1965. 192 p. \$2.75.
- Cromie, William J. *Exploring the Secrets of the Sea*. Englewood Cliffs, NJ, Prentice-Hall, 1962. 300 p. \$6.95.
- \_\_\_\_\_. *The Living World of the Sea*. Englewood Cliffs, NJ, Prentice-Hall, 1966. 343 p. \$6.95.
- Daniel, H. and F. Minot. *The Inexhaustible Sea*. New York, NY, Collier Books, \$ .95.
- Dubach, Harold W. and Robert W. Taber. *Questions About the Oceans*. Washington, DC, U.S. Naval Oceanographic Office, 1968. 121 p. \$ .55.
- Duddington, C. L. *Flora of the Sea*. New York, NY, Thomas Y. Crowell Co., 1967. 207 p. \$6.95.
- Dugan, James. *Man Under the Sea*. New York, NY, Harper & Row, 1956. 332 p. \$7.50.
- Dugan, James and others. *World Beneath the Sea*. Washington, DC, National Geographic Society, 1967. 204 p. \$4.25.
- Fisher, James and R. M. Lockley. *Sea Birds*. Boston, Ma, Houghton Mifflin Co., 1954.
- Frey, H. and S. *Diver Below!* New York, NY, Collier Books, 1969. 182 p. \$2.95.
- Frey, Hank and Paul Tzimoulis. *Camera Below*. New York, NY, Association Press, 1968. 224 p. \$12.00.
- Gordon, Bernard L., ed. *Man and the Sea*. Garden City, NY, The Natural History Press, 1970. 480 p. \$9.95.
- Gramling, Homer. *Skin and Scuba Diving -- A Basic Guide*. New York, NY, The Ronald Press Co., 1964. 184 p. \$5.00.
- Greenberg, Jerry. *Underwater Photography Simplified*. Coral Gables, Fl, Sea Hawk Products, 1963. 48 p. \$2.00.
- Gross, M. Grant. *Oceanography*. Columbus, Oh, Charles E. Merrill Publishing Co., 1971. 150 p. \$2.75.
- Guberlet, Muriel L. *Animals of the Seashore*. Portland, Or, Binford and Mort, 1962 (3rd edition). 450 p.
- \_\_\_\_\_. *Explorers of the Sea*. New York, NY, The Ronald Press Co., 1964. 225 p. \$4.50.
- Hausman, Leon A. *A Beginner's Guide to Seashore Life*. New York, NY, G. P. Putnam's Sons, 1949. \$2.75.
- Hahn, J. *1001 Questions Answered About the Ocean*. New York, NY, Dodd, Mead and Co., 1965.
- Hardy, Alister C. *The Open Sea: Its Natural History*. Boston, Ma, Houghton Mifflin Co., 1964 \$15.00.

- Herald, Earl S. *Living Fishes of the World*. Garden City, NY, Doubleday and Co., 1961. 304 p. \$14.95.
- Hull, Seabrook. *The Bountiful Sea*. Englewood Cliffs, NJ, Prentice-Hall, 1964. 340 p. \$6.95.
- Idyll, C. P., ed. *Exploring the Ocean World*. New York, NY, Thomas Y. Crowell. \$14.95.
- \_\_\_\_\_. *Abyss: The Deep Sea and the Creatures That Live In It*. New York, NY, Thomas Y. Crowell, 1964. 396 p. \$6.95.
- Kovalik, Vladimir and Nada. *The Ocean World*. New York, NY, Holiday House, 1967. 191 p. \$4.50.
- \_\_\_\_\_. *The Complete Illustrated Guide to Snorkel and Deep Diving*. Garden City, NY, Doubleday & Co., 1963. 467 p. \$7.50.
- Lee, Owen S. *The Skin Diver's Bible*. Garden City, NY, Doubleday & Co., 1968. 160 p. \$1.95.
- Lilly, J. C. *Man and Dolphin*. Garden City, NY, Doubleday & Co., 1961. 312 p. \$4.95.
- Long, E. J. *New Worlds of Oceanography*. New York, NY, Pyramid Publications, Inc., 1965. 221 p. \$1.75.
- Marshall, N. B. *The Life of Fishes*. New York, NY, World Publishing Co., 1966. 402 p. \$12.50.
- Marx, Wesley. *The Frail Ocean*. New York, NY, Ballantine Books, 1969. 274 p. \$1.95.
- Miner, Roy W. *Field Book of Seashore Life*. New York, NY, G. P. Putnam's Sons, 1950. 838 p. \$8.00.
- National Geographic Society. *Wondrous World of Fishes*. Washington, DC, National Geographic Society, 1965. 366 p. \$9.95.
- Nilsson, L. and G. Jagersten. *Life in the Sea*. London, G. T. Foulis, 1961. 184 p. \$10.00.
- Norman, J.R. and F. C. Fraser. *Giant Fishes, Dolphins and Whales*. New York, NY, G. P. Putnam's Sons, 1938.
- North, W. J. *Golden Guide to Scuba Diving; Handbook of Underwater Activities*. New York, NY, Golden Press, 1968. 160 p. \$1.25.
- Pell, Claiborne and Harold Leland Goodwin. *Challenge of the Seven Seas*. New York, NY, William Morrow and Co., 1966. 306 p. \$6.95.
- Perlmutter, Alfred. *Guide to Marine Fishes*. New York, NY, New York University Press, 1961. 331 p. \$6.50.
- Piccard, Jacques. *The Sun Beneath the Sea*. New York, NY, Charles Scribner's Sons, 1971. 405 p. \$12.50.
- Piccard, Jacques and R.S. Dietz. *Seven Miles Down*. New York, NY, G. P. Putnam's Sons, 1961. 249 p. \$6.95.
- Randall, John. *Caribbean Reef Fishes*. Miami, FL, Coral Reef Exhibits, 1968. 318 p. \$12.50.
- Ray, Carleton. *Wonders of the Living Sea*. New York, NY, Home Library Press, 1963. 56 p. \$3.50.
- Ray, Carleton and Elgin Ciampi. *The Underwater Guide to Marine Life*. New York, NY, A.S. Barnes and Co., 1956. 388 p. \$8.75.

- Rebikoff, Dimitri and P. Cherney. *Underwater Photography*. Philadelphia, Pa, Chilton Book Co., 1965. 126 p. \$5.95.
- Russell, F.S. and C.M. Yonge. *The Seas*. London, Frederick Warne & Co., Ltd., 1963. 376 p. \$7.95.
- Shenton, Edward H. *Exploring the Ocean Depths*. New York, NY, W.W. Norton and Co., 1968. 205 p. \$5.95.
- Silverberg, Robert. *The World of Coral*. New York, NY, Duell, Sloan and Pearce, 1965. 150 p. \$3.95.
- Slosky, Bill and Art Walker. *Guide to the Underwater*. New York, NY, Sterling Publishing Co., 1966. 192 p. \$7.95.
- Soule, Gardner. *The Ocean Adventure*. New York, NY, Appleton-Century-Crofts, 1966. 278 p.
- \_\_\_\_\_. *Undersea Frontiers*. New York, NY, Rand-McNally, 1968. 253 p. \$6.95.
- Southward, A.J. *Life on the Seashore*. Cambridge, Ma, Harvard University Press, 1965.
- Starck, Walter A. and Paul Brundza. *The Art of Underwater Photography*. Philadelphia, Pa, Chilton Book Co., 1966. 160 p. \$7.95.
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- Stewart, Harris B., Jr. *The Global Sea*. Princeton, NJ, Van Nostrand, 1963. 126 p. \$1.95.
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# The Oceans and You

## SOURCES OF INFORMATION

Beyond the sources of information previously listed in this kit, (government agencies, colleges and universities, industries and the bibliography), there are numerous additional sources. This compilation is intended to suggest the variety of possibilities; many of the reference works cited in the bibliography will include additional suggestions.

One word of caution: make your inquiry as specific as possible. Show the person you are asking for information that you have done enough investigation on your own to be able to ask for data the recipient is likely to have.

DO NOT write any of the information sources for everything they possess about the oceans. Focus your inquiry to some specific aspects that are of interest and which you feel the office you are writing knows something about.

A prime source of continuing information is membership (or student membership) in the Marine Technology Society for \$20 (Student \$10) per year. Members receive a monthly newsletter on the latest developments in science, government and industry; publication and meeting discounts; eligibility to participate in local sections and professional committees; a bi-monthly professional Journal and, in general, a means of contact with some of the leading participants in ocean affairs today.

Other organizations which might serve as sources of useful information include the following (note that this list is not comprehensive, but suggestive of the wide range of private organizations with ocean interests):

### PRIVATE ORGANIZATIONS

American Cetacean Society, 4725 Lincoln Blvd., Marina del Ray, CA 90291

American Fisheries Society, 1319 18th Street, N.W. Washington, D. C. 20036

American Geological Institute, 2201 M St., N.W., Washington, D. C. 20037

American Geophysical Union, 1707 L St., N.W., Washington, D. C. 20036

American Institute of Biological Sciences, Inc., 3900 Wisconsin Ave., N.W. Washington, D. C. 20016

American Littoral Society, Sandy Hook, Highlands, NJ 07732

American Society of Limnology and Oceanography, c/o Dr. George W. Saunders, Department of Zoology, University of Michigan, Ann Arbor, MI 48104

Izaak Walton League of America, 1326 Waukegan Rd., Glenview, IL 60025

National Academy of Sciences, Ocean Affairs Board and Academy of Engineering, Marine Board, 2101 Constitution Avenue, N.W., Washington, D. C. 20418

National Wildlife Federation, 1412 16th St., N.W., Washington, D. C. 20036

Sierra Club, 1050 Mills Tower, San Francisco, Ca 94104

Sport Fishing Institute, 719 15th St., N.W., Washington, D. C. 20005

## GOVERNMENT AGENCIES

As a general rule, direct your inquiry to the public information/affairs office of the department or agency you are writing; they are equipped to handle public inquiries. If possible, tailor your request to the material the agency has on hand--i. e., ask the Interior Department for geological survey information since the Geological Survey Office is located in the department.

The agencies represented in the government employment outlook section of this kit represent principal sources of information. That includes the Navy, the National Oceanic and Atmospheric Administration, the Coast Guard, Environmental Protection Agency and Maritime Administration.

(For the Navy you can contact any facility near you for assistance as well as the headquarters offices. The principal sources of information would be the Naval Oceanographic Office, Suitland, Md 20390; Office of the Oceanographer of the Navy, 732 N. Washington Street, Alexandria, Va 22314; and Information Office, Department of the Navy, The Pentagon, Washington, D. C. 20350.)

(Within the National Oceanic and Atmospheric Administration are the National Marine Fisheries Service, National Ocean Survey, Sea Grant College Program and National Weather Service among the principal components. Address all inquiries about their functions to: Public Affairs Office, NOAA, Department of Commerce, Rockville, Maryland 20852.)

Other good sources:

- Office of Information, Department of the Interior, Washington, D. C. 20240 (In addition to Geological Survey, contains Bureau of Sport Fisheries and Wildlife, Office of Saline Water, Office of Water Resources Research and National Park Service which might be of interest).
- National Science Foundation, 1800 G St., N. W., Washington, D. C. 20550 (supports International Decade of Ocean Exploration, Deep Sea Drilling Project, Center for Atmospheric Research and a number of other programs relating to the oceans and atmosphere).
- Smithsonian Institution Office of Environmental Sciences, Washington, D. C. 20560 and the Smithsonian's Scientific Information Exchange, 1730 M St., N. W., Washington, D. C. 20036.
- Public Affairs Office, National Aeronautics and Space Administration, 600 Maryland Ave., S. W., Washington, D. C. 20546.

## PUBLICATIONS

Many of the organizations, government agencies and academic institutions listed in this kit produce publications of various kinds. (For instance, the University of Rhode Island publishes "Maritimes" four times a year; the National Oceanic and Atmospheric Administration produces the quarterly magazine "NOAA" for its employees which is available for a subscription of \$1.25 per year; many of the larger industries cited in the directories mentioned in the industrial job outlook section of the kit likewise produce pamphlets and other publications describing their ocean endeavors and products; the Marine Technology Society produces the "Ocean Soundings" newsletter each month for its members, as do a number of other organizations cited above.)

Additionally there are available the following publications:

Marine Fisheries Review, National Marine Fisheries Service/NOAA,

Department of Commerce, Washington, D. C. 20235. \$7.00 per year. Monthly.

CF Letter, Conservation Foundation, 1717 Massachusetts Ave., N. W., Washington, D. C. 20036. \$6.00 per year. Monthly.

Conservation Report, National Wildlife Federation, 1412 16th St., N. W., Washington, D. C. 20036. Free. Weekly when Congress in session.

Hydrospace, 2 Fife Road, Kingston-upon-Thames, Surrey, England. \$12.00 per year. Monthly.

Journal of Physical Oceanography, American Meteorology Society, 45 Beacon Street, Boston, Ma 02108. \$20.00 per year. Quarterly.

Limnology and Oceanography, Allen Press, Lawrence, Ks 66044. \$15.00 per year. Bi-monthly.

National Fisherman, Camden Me 04843. \$6.00 per year. Monthly.

Naval Research Reviews, Code 740, Office of Naval Research, Washington, D. C. 20390. \$1.50 per year. Monthly.

Ocean Industry, P. O. Box 2608, Houston, Tx 77001. Free to qualified persons or \$12.00 per year. Monthly.

Ocean Science News, 1056 National Press Building, Washington, D. C. 20004. \$165.00 per year. Weekly.

Oceans, 125 Independence Drive, Menlo Park, Ca. 94025. \$12.00 per year. Bi-monthly.

Science, 1515 Massachusetts Avenue, N. W., Washington, D. C. 20005. \$20.00 per year. Weekly.

Skin Diver, 8490 Sunset Blvd. Los Angeles, Ca. 90069. \$7.50 per year. Monthly.

UnderSea Technology, 1117 N. 19th Street, Arlington, Va. 22209, free to qualified persons or \$10.00 per year. Monthly.

The Underwater Letter, Box 3751, Washington, D. C. 20007. \$100.00 per year. Thirty-six printed per year.

## FINANCIAL ASSISTANCE

Scholarships, fellowships and other assistance programs are available at most colleges and universities. While such aid may not be specifically earmarked for oceanographic study, students in the marine science field have an opportunity to apply and compete for most scholarships, fellowships and aid on an equal basis with students in other disciplines.

Many universities participate in Federal and state student assistance programs. The institutions themselves usually administer such programs and determine who the recipients of aid will be.

Students hoping to obtain such assistance should contact the university's financial aid officer. (This official is sometimes known by another designation, but correspondence addressed to the financial aid officer will reach the proper party.) Students who are already attending a college or university may want to consult their adviser or one of their professors before they contact the financial aid officer.

Advisers and professors will be able to inform students about scholarships, fellowships, etc., available at the college or university of their choice. The sources of such assistance include government, Federal and state; foundations and business corporations; and, the colleges and universities themselves.

The Federal government has four basic assistance programs (plus some specialized aid programs offered by the Veterans Administration, Bureau of Indian Affairs and Reserve Officer Training Program) from the U. S. Office of Education. They are the National Defense Student Loan Program, College Work-Study Program, Guaranteed Loan Program and Educational Opportunities Grant Program. For information, write: U. S. Office of Education, Division of Student Financial Assistance, Washington, D. C. 20202.

State governments, foundations and major corporations also are sources of financial aid. As with the Federal programs, they almost always are administered by the college or university.

An excellent general reference on scholarships is published by the American Legion. Revised annually and entitled "Need a Lift?" it is available in high school libraries and guidance counselor offices. For a copy send 50 cents to: American Legion, Department S, P. O. Box 1055, Indianapolis, In. 46206.

Also available from the Government Printing Office, Washington, D. C. 20402 for 15 cents prepaid is "Financing a College Science Education."

# The Oceans and You

## PERSONAL ACTIONS

There are a variety of things an individual can do (or, as is often the case, not do) that will contribute to an improved aquatic environment. Particularly critical are the estuarine areas -- the shallow bays, sounds and coastal waters -- highly productive environments that are the base of the marine food chain and thus the source of most of our commercial fish harvest as well as serving as important recreation areas.

Perhaps the first step for the concerned individual is to become informed. Learn about the biological importance of estuaries, for instance, so that you will be in a position to assess the damage done by the various pollutants entering these areas.

Become informed also about what's being done (or not being done) to clean up the waterways in your region. All the rivers empty into estuarine areas on their way to the ocean; no matter how far you are from a coastal environment, the quality of your waterways will have its effects on a distant bay and coastal area.

Join with a local action group working for improved water quality. Join also a national organization such as the Marine Technology Society not only to obtain current information but to add your weight to the growing number of citizens concerned about our ocean, coastal and estuarine environments.

In your personal lifestyle there are a number of actions you can take. By your example you can encourage others to become concerned with water quality (not to mention other environmental problems such as in solid waste).

- Although there is considerable controversy about the question, it seems clear that it is preferable to use detergents which are low in phosphates. This is because in many situations the artificial addition of phosphates speeds plant growth which in turn consumes dissolved oxygen in the water and drives off other forms of life. Care should be exercised in using some types of non-phosphate detergents.

- It is recommended that colored toilet paper be avoided since the dyes used can be harmful to aquatic life.

- Try to avoid home use of pesticides made from chlorinated hydrocarbons such as DDT, chlordane, dieldrin and similar substances which scientists are finding have long lives and do damage to some wildlife.

- By curtailing as much as possible your personal consumption of water and fuel you will contribute your part to reducing the demand on our resources; of course by persuading others to do the same your impact will be larger.

- Recycle as many of the items you use as possible, such as newspapers, soft drink containers or grocery bags. If there is a recycling center in your area, be sure to make use of it.

- Curtail your uses of electricity as much as possible to help reduce the energy demand in this country.

In taking these and similar steps, it is helpful for the individual to

remember that he/she is not alone. As reported in the annual report of the Council on Environmental Quality, a Presidential advisory body, issued August, 1971:

"The American citizen is becoming better informed on the major issues of pollution, recycling, land use, and other environmental matters. His variety of activity is considerable -- and growing. He is lobbying legislators, enforcing environmental standards in court, and swaying elections on the basis of environmental issues.

"As he becomes more knowledgeable about the impact of the action of public bodies and private interests, the citizen will participate with still more success in the political processes that are essential to upgrading environmental policy and quality.

"The private sector remains the key arena for environmental improvement. The stimulus for such improvement must come from the citizen. His approval must be won for necessary public expenditures, such as those for sewage treatment. Much of the ultimate responsibility for action -- to meet pollution control standards and to take the environment into account in a wide variety of decisions that will affect it -- falls upon individuals and firms in the private sector."

Here is an overall list of suggested personal actions from the Environmental Protection Agency (from EPA Citizen's Bulletin, March 1972):

- Promote clean-up campaigns of shorelines, streambeds, parks, roadsides.
- Don't burn trash or leaves.
- Keep home furnaces clean and operating properly.
- Keep car engines tuned and operating properly.
- Use public transportation whenever possible.
- Cut down unnecessary use of electricity and water.
- Don't use persistent pesticides.
- Don't litter.
- Take waste cans, bottles and newspapers to recycling centers. Keep the volume down on televisions, radios and phonographs.
- Refuse to buy products made from the fur, feathers or hides of endangered species.
- Speak out on environmental issues through letters to the press and public officials.
- Support citizen environmental organizations.



## Membership Application

Name \_\_\_\_\_

Title \_\_\_\_\_

Address \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_ Phone \_\_\_\_\_

Institution or Company \_\_\_\_\_

Professional or research interest \_\_\_\_\_

I, \_\_\_\_\_

hereby apply for membership in the Marine Technology Society  
and enclose \$ \_\_\_\_\_

**MEMBER.** Any person active in the marine sciences, technologies, or related fields who has an academic degree or its equivalent or professional experience in the marine field. Annual membership - \$20.00  
 **ASSOCIATE.** Any person interested in the marine sciences, technologies, or related fields. Annual membership - \$20.00  
 **STUDENT.** Available only to bona fide students. Annual membership - \$10.00

**INSTITUTIONAL.** Any library, governmental unit or other qualified non-profit organization endorsing the objects, policies and activities of the society. Annual membership - \$100.00

**CORPORATE.** Any corporation or organization endorsing the objects, policies, and activities of the society. Annual membership - \$200.00

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